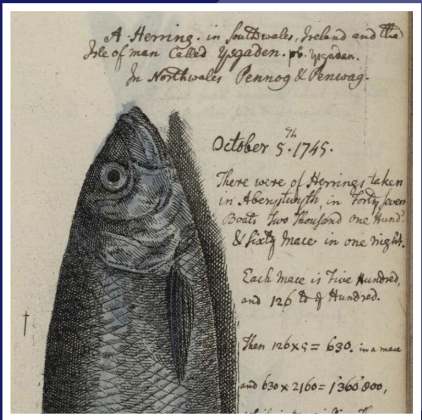
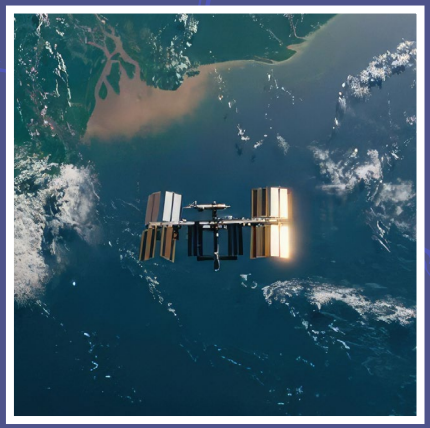
UK Research and Innovation

UKRI incentivising and removing barriers to interdisciplinary research

Awarded projects from round 1 of the Cross research council responsive mode pilot scheme (CRCRM)





Arts and Humanities Research Council

Biotechnology and Biological Sciences Research Council

Engineering and Physical Sciences Research Council

Economic and Social Research Council

Medical Research Council

Natural Environment Research Council

Science and Technology Facilities Council

Scan here for the CRCRM webpage

About the CRCRM scheme

The cross-research council responsive mode (CRCRM) pilot scheme supports emerging ideas from the research community that transcend, combine, or significantly span disciplines, to ensure all forms of interdisciplinary research have a home within UKRI. £65 million will be awarded through the pilot scheme across two rounds.

The CRCRM is a new pilot scheme designed to stimulate exciting new interdisciplinary research by:

- unlocking new research, approaches and methods that would not be possible from established disciplinary thinking
- encouraging new and unexpected types of interdisciplinary research not currently funded through existing UKRI responsive mode schemes
- supporting research that will be potentially transformative for the participating disciplines or lead to the creation of new disciplines.

An Interdisciplinary Assessment College (IAC), comprising members with experience of working in or supporting interdisciplinary research, has been appointed and specifically trained for the assessment of applications to the scheme.

Through this novel assessment process, we anticipate that we will identify and support new interdisciplinary research projects that, through current UKRI routes, may struggle to secure support.

Foreword

Professor Alison Park
UKRI CRCRM Champion
Deputy Executive Chair of the Economic and Social Research Council (ESRC)

The perspectives of different disciplines, working together in collaboration, are vital to solving some of the most pressing problems we face as a society. The UKRI cross research council responsive mode pilot scheme (CRCRM) is designed to break down silos and champion research that transcends, combines and significantly spans traditional discipline boundaries. It adds a new source of support to the many ways in which UKRI already funds interdisciplinary research.

This booklet summarises the 36 projects funded through round 1 of the CRCRM pilot scheme. Each is conducting research based on exceptional interdisciplinary practice, creating fresh approaches to their research questions, methodologies and ways of working, and driving progress across a wide array of fields. UKRI and our appointed Interdisciplinary Assessment College were genuinely excited to see the innovative and bold approaches being adopted, and the breadth of issues being tackled - from climate change to global healthcare. We look forward to following their progress.

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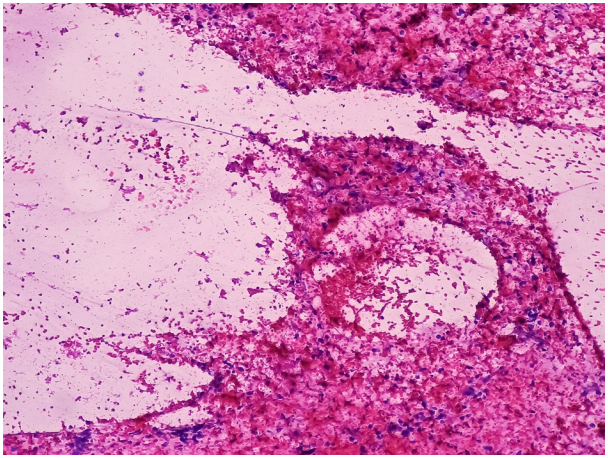
Combining a snake-like robot with wireless electrical-molecular signalling to tackle cholangiocarcinoma (CCA)

Bile duct cancer (cholangiocarcinoma) affects 3000 people in the UK each year, with only 13% of patients surviving 3 years. The project brings together experts in medicine, endoscopy, engineering, robotics, physics, imaging, bioelectrics and genomics to improve the accurate diagnosis and treatment of bile duct cancer.

The project will develop an ultra-slender snake-like robot technology that will be used to navigate the narrow bile duct and capture images to inform the design of a 3D map. Stents, loaded with nanoparticles, will be delivered into the bile duct and activated using wireless electrical fields to stimulate the death of cancer cells.

The combined approach will create the capability to deliver treatment with greater precision with the expectation it will lead to the improved survival and quality of life for patients with CCA.



Project Lead and Co-Leads:
Guruprasad Aithal, Abdelkhalick Mohammad, Abhik Mukherjee, Alan Mcintyre, Anna Grabowska, Dragos Axinte, Frankie Rawson, George Gordon, Ioan Notingher, Jane Grove, Kenton Arkill, Kevin Gaston, Padma-Sheela Jayaraman, Xin Don – *University of Nottingham*
Arvind Arora, Dhanny Gomez, Martin James, Philip Kaye, and Suresh Venkatachalapathy – *Nottingham University Hospitals NHS Trust*

University of Nottingham UK | CHINA | MALAYSIA

Nottingham University Hospitals NHS
NHS Trust

Realtime wireless monitoring of inflammation for improved healthcare outcomes

Implanted medical devices often fail due to adverse inflammatory responses. This can severely impact a patient's health and require costly revisions, extended hospital stays and increase mortality rates.

This interdisciplinary collaboration will address the challenge of implant failure by monitoring the changes in the body's response to implanted devices in real-time with a non-invasive device.

The wireless sensing approach will enable monitoring of inflammatory responses to implants in any clinic or research lab, without the need for advanced imaging equipment and will aid the development of new implant designs.

Project Lead and Co-Leads:
Morgan Alexander, Amir Ghaemmaghami, Emma Wilmot, Frankie Rawson and Jeni Lucket – *University of Nottingham.*

Project Partner Organisations:
MIT Koch Institute, Rice University, Medtronic

Looking Inside Living Algal Cell Wall — A Soft Matter Approach

Marine organisms, such as algae, are remarkably versatile; they have adapted themselves to virtually every ocean and freshwater ecosystem on the planet over 1.5 billion years of evolution.

This complexity and adaptivity underlines the fascinating material properties of the marine cell wall, which remains poorly understood. This project seeks to explore, explain, and exploit the diversity of marine cell walls by combining tools, materials and perspectives from bioscience, physics and the chemical sciences.

This knowledge is essential for predicting how marine organisms will adapt to climate change and will aid in the development of novel adaptive biomaterials that are derived from natural feedstocks.

Project Lead and Co-Leads:
Anders Aufderhorst-Roberts – *University of Liverpool*
John Girkin, John Bothwel – *Durham University*
Marina Kuimova and Anna Barnard – *Imperial college London*

A novel, real-time tuberculosis detector for animals and humans

Tuberculosis (TB), is a major cause of suffering and death in humans worldwide. Bovine Tuberculosis (bTB) is a particular problem for farmers in Wales who have seen bovine TB decimate herds across the country.

The bacteria that cause TB and bTB are very closely related. Diagnosis of infection is challenging due to the lack of rapid, accurate testing. To address this issue researchers in veterinary medicine, microbiology, microwave and photonic engineering will advance the development of a real time diagnostic assay capable of detecting the presence of the bacteria in clinical and environmental samples.

The technology will be simple enough to be operated by any healthcare worker or farmer and further development to reduce the size and cost will have particular benefit for use in developing countries. In the future it could easily be adapted to detect most other pathogens, becoming an important tool to help control the spread of future pandemics.

Project Lead and Co-Leads:
Les Baillie, Jonnathan Lees, Heungjae Choi – *Cardiff University*
Glyn Hewinson, Amanda Gibson, Nigel Copner – *Aberystwyth University*

Advanced interdisciplinary models of destructive lung disease

Destructive lung diseases are the third largest cause of death worldwide and Chronic Obstructive Pulmonary Disease alone costs the NHS £1.9bn each year. The diseases are characterised by destruction of the tissue that make up the air sacs within the lung, and progressive loss of lung function.

The mechanisms by which injury, abnormal repair processes and tissue mechanics interact to cause this destruction are not well understood. This gap in understanding delays diagnosis, timely treatment, and personalised care.

This project will develop novel combinations of biological and imaging data with mathematical and computational models to help establish the relationship between the lung tissue loss and the injury - repair processes at the genetic and cellular levels.

These tools will help us better understand the underlying mechanisms and determine new sensitive biomarkers to detect active disease, enabling early interventions to prevent lung damage and death, and ultimately facilitating the rapid evaluation of new treatments.

Project Lead and Co-Leads:
Bindi S Brook, Simon R Johnson, Ian Sayers, Reuben O'Dea – *University of Nottingham*
Gowsihan Poologosundarampillai – *University of Birmingham*
Himanshu Kaul – *University of Leicester*

Project Partner Organisations:
University College London (HOAHub),
University of Manchester (BIOREME), Diamond Light Source

University of Nottingham UK | CHINA | MALAYSIA
UNIVERSITY OF BIRMINGHAM
UNIVERSITY OF LEICESTER

Microbes that listen: Using ultrasonic bubbles to help microbes destroy persistent organic pollutants

Engineers, microbiologists, physicists and chemists will work together on new ways to get rid of some of the most recalcitrant pollutants in our biosphere; per- and poly-fluorinated alkyl substances (PFAS).

A new hybrid technology combining ultrasonic bubbles (sono) and microorganisms (bio) will be researched. The new technology will use the bubbles to help microbes break down large pollutant molecules while at the same time, use the bubble collapse to destroy small pollutant molecules. New analytical methods will be researched to understand the combined sono-bio system.

Project Lead and Co-Leads:
Madeleine Bussemaker, Claudio Avignone Rossa, Patrick Sears and Melanie Bailey – *University of Surrey*

Project Partner Organisations:
Technical University of Denmark, Cornelsen, Waters Corporation and Romil

UNIVERSITY OF SURREY

Imaging live Antarctic cells at sub-zero temperatures using high resolution microscopy

The project will develop the first high resolution microscope systems to study the real-time behaviour of proteins in Antarctic fish cells at sub-zero temperatures. The research goal is at the very intersection of biology, physics, engineering and chemistry, and will transform our understanding of evolutionary adaptation to life in the cold and how it will be affected by climate warming.

This project has further applications in medicine, such as long-term storage of therapeutic proteins and cryopreservation, and innovative applications in developing low temperature enzymes for societal benefit. The project will also lead to the advancement of imaging technologies for use in hazardous conditions such as high-level biological containment laboratories.

Project Lead and Co-Leads:
Melody Clark, Lloyd Peck – *British Antarctic Survey*
Clemens Kaminski – *University of Cambridge*

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

UNIVERSITY OF CAMBRIDGE

Ecological Knowledge Games: Bridging social-ecological models, decision-making data, and videogames

This novel interdisciplinary research programme will integrate the rich, complex and immersive environments of online video games with real world ecological and social models.

The new modelling software will enable researchers to conduct *in silico* experiments to understand and find solutions for wicked problems.

Through the games, the project will engage with, and give a voice to, under-represented communities and will give researchers and policy-makers access to a new range of information and tools for delivering on urgent United Nations Sustainable Development Goals.

Project Lead and Co-Leads:
Brad Duthie, Nils Bunnefeld, Conor McKeown – *University of Stirling*
Diana Valero, Jianyu Chen – *James Hutton Institute*
Yuan Pan – *King's College London*

Project Partner Organisations:
Marist College

Protocol development and feasibility study for the elevated childhood lead interagency prevalence study

Lead pollution is a global problem and toxic even in small amounts. It is common in our environment due to past use in paint, petrol and plumbing, contaminating our air, water, soil, dust and food. Children are more at risk from the effects of lead because of their growing and developing brains. Lead exposure is preventable.

This project will develop and trial a new child screening procedure to make home blood sample collection for lead testing easy, quick and stress-free. Widespread monitoring of the amount of lead in blood will help to develop policies that reduce children's contact with lead in the community and at home.

The resulting new interdisciplinary method re-frames biomonitoring as a community-science activity: families are an integral part of the data collection, in their own home, and are supported to identify approaches to reduce lead exposure.

Project Lead and Co-Leads:
Jane Entwistle, Lindsay Bramwell – *Northumbria University,*
Frank DiTraglia – *University of Oxford*
Ludovica Gazze – *University of Warwick*
Carys Lippiatt – *Leeds Teaching Hospitals NHS Trust*
Priya Mondal, Ovnair Sepai – *UK Health Security Agency*
Jackie Morton – *Health and Safety Executive*
Caroline Taylor – *University of Bristol*

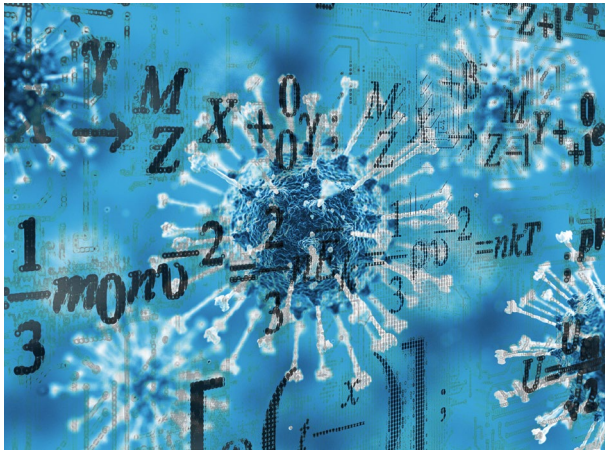
Project Partner Organisations:
LEAPP Alliance, Synnovis

Mathematical modelling of epidemics

Epidemic infectious disease models are an essential piece of pandemic preparedness. Mathematical modelling of infectious diseases is used to guide high-impact decision-making about epidemic response at speed and the consequences of these decisions are felt unequally across society. However, there is a lack of guidance to integrate public voices into the design and analytical directions of epidemiological models.

In this project researchers, practitioners and the public will work together, sharing power and responsibility as equal partners in research.

Through integrating understanding across epidemiology, maths, social sciences, human centred design and linguistics we will iteratively develop approaches, guidance and tools to enable co-production of epidemic modelling that are inclusive and can deliver positive change across diverse groups in society.



Project Lead and Co-Leads:
Elizabeth Fearon, Niccola Pascal-Hutchinson, Beth Malory, Emily Nicholls, Shema Tariq – *University College London*
Thomas House, Caroline Jay – *University of Manchester*

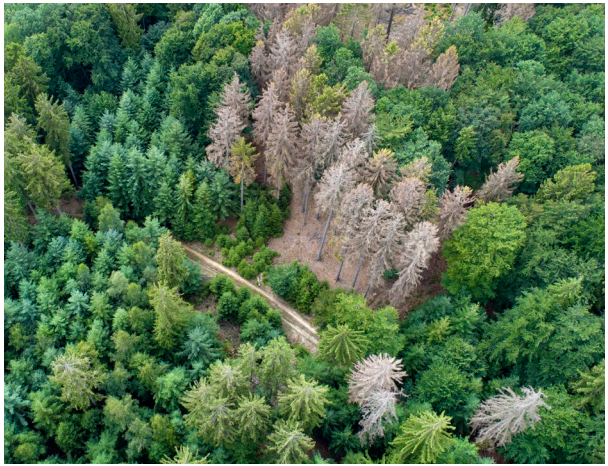
Project Partners:
UK Health Security Agency, JUNIPER Partnership

FUSION FOREST: a holistic approach for the design of disease-suppressing treescapes

The UK government has set a target to increase the woodland cover to 12% by 2060 but with an alarming increase in tree epidemics the future of our woodlands is at risk.

The Fusion Forest project will provide strategies and tools to enhance the natural immunity of forests and halt tree epidemics. It will combine knowledge on tree immunity with ecology and physics and by proposing combinations of tree species and priming of defence we will increase forest resilience. We will create a tool, ForestFlow, that brings together ecological and physical modelling to predict the spread of fungal spores and design physical barriers to it.

Fusion Forest will prevent high disease pressures and enhance tree immunity ahead of the occurrence of outbreaks. The decisions we make today will determine the forest landscapes of future generations.



Project Lead and Co-Leads:
Bruño Fraga, Estrella Luna, Juliano Sarmento Cabral
– University of Birmingham

Project Partner Organisations:
ANSYS, Future Trees Trust, Norbury Park Estate, DEFRA

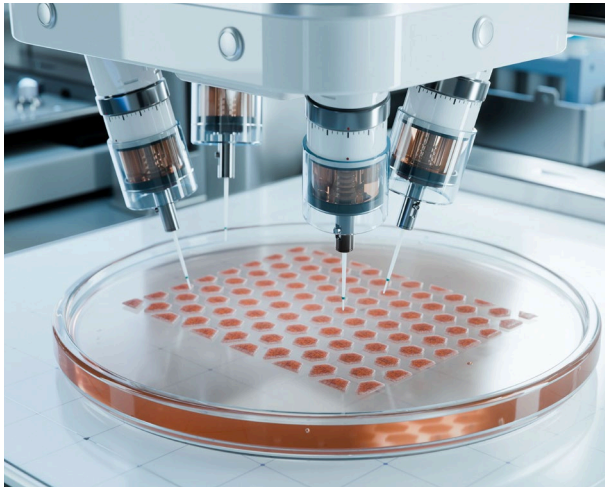
UNIVERSITY OF BIRMINGHAM

Three-dimensional spatial patterning of tissue development dynamics using light-addressable small molecule morphogens

Tissue engineering holds great promise for revolutionising healthcare, in particular to enable therapeutic approaches to repair or regenerate tissues and organs. However, realising its huge potential will need new and disruptive methods.

The pattern and shape of developing tissue is governed by the dynamic regulation and distribution of soluble biological ligands called morphogens. Replicating this to recreate the three-dimensional complexity of human tissues for engineering purposes presents a significant and unsolved challenge.

Using a team with expertise spanning physics, engineering, chemistry, biochemistry, molecular, developmental and stem cell biology, this project aims to develop light-sensitive and biologically-active morphogens to enable precise spatiotemporal control of complex tissue development.



Project Lead and Co-Leads:
Matthew Fuchter, Davia Prischich – *University of Oxford*
Serge Mostowy – *London School of Hygiene and Tropical Medicine*
James Briscoe – *Francis Crick Institute*
Christopher Rowlands – *Imperial College London*

Contact tracing, infection and transmission

The COVID-19 pandemic underlined the continuing threat from emerging zoonotic diseases. Contact tracing is important in the control of such diseases but the notion of "contact" is often poorly understood and there is limited information on the wide variety of interactions that may occur between individuals, particularly in lower-income settings where epidemic/pandemic threats most frequently emerge.

Studying interpersonal contact requires using a truly interdisciplinary perspective which fully embraces past history and local cultural traditions of interaction. It needs understandings of disease risk, communication patterns between the general population and places of potential infection/transmission, biological characteristics associated with different viruses, and an appreciation of how this information may be combined to model and modify contact patterns to limit infection and spread.

The project will provide important evidence on which to build novel policies and adaptations with the potential to enhance and disrupt our current understanding of pathogen transmission, with the ultimate goal of mitigating the impact of infectious diseases around the world.

Project Lead and Co-Leads:
Robin Goodwin, Elise Smith, Anna Six, Nicole Robb – *Warwick University*
Michael Head, Markus Brede, Winfred Dotse-Gborgbortsi – *University of Southampton*
Robin Thompson – *University of Oxford*
Wirichida Pan-Ngum – *University of Oxford and Mahidol Hospital (Thailand)*
Arunya Tuicomepee, Juthatip Wiwattanapantuwong, Dangkamon Napombejra – *Chulalongkorn University (Thailand)*
John Odoom, University of Ghana and Eliasu Mumuni – *University of Development Studies (Ghana)*

Biochar as a sustainable building material

Biochar is a charcoal-like substance, produced from organic waste biomass. It is carbon-rich and chemically-stable and therefore offers enormous potential to combat climate change.

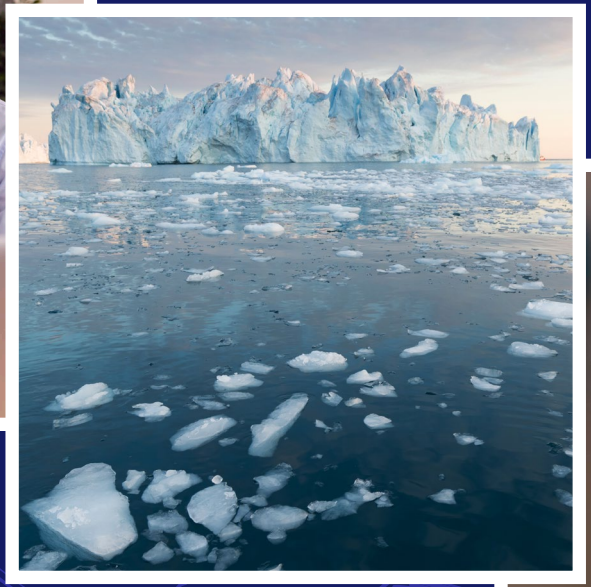
This project aims to provide an evidence base for adopting biochar within building projects, providing awareness and reassurance of the technology to the building industry and the wider public about its use.

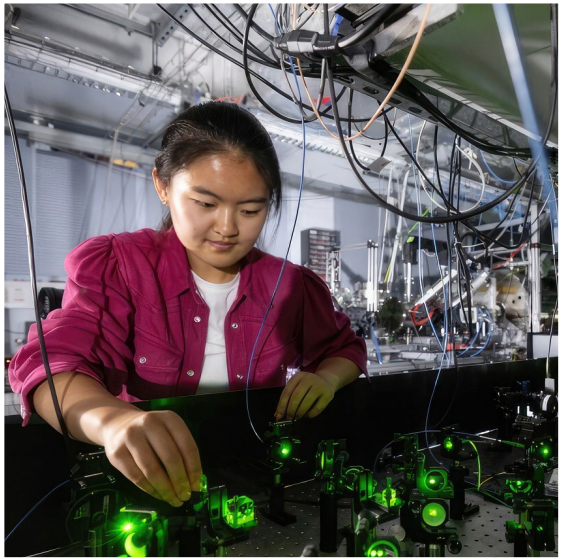
The interdisciplinary approach brings together civil engineering, building modelling and social science to develop a techno-economic roadmap, with input from multiple stakeholders, that will match the best biochar applications to specific building models. The project will highlight the potential carbon and energy savings and affordability for different building types.

Increasing the use of biochar in the buildings industry will contribute significantly to CO2 reductions, helping the government meet net zero emissions targets.

Project Lead and Co-Leads:
Mehreen Gul, David Jenkins – *Heriot-Watt University, Edinburgh*
Dulini Fernando – *Aston University Birmingham*
Moura Mehravar – *University of Birmingham*

Project Partner Organisations:
Built Environment Smarter Transformation (BE-ST), ecoLocked, Chartered Institution of Building Services Engineers (CIBSE), Enchar, Scottish Forestry, Carbonfuture, Stirling Developments, Energy Technology Partnership (ETP)





Using living artworks and citizen science to drive evidence-based pollinator conservation

Pollinators globally are in precipitous decline, despite providing critical ecosystem services.

Pollinator Pathmaker is an award-winning living artwork by Alexandra Daisy Ginsberg that addresses the pollinator crisis by algorithmically generating planting designs optimised for pollinator diversity, rather than using human garden design principles.

The project will use *Pollinator Pathmaker* as a model system to explore how living artworks can conserve pollinator diversity in limited and fragmented urban green spaces and how these artworks empower publics to engage in nature-positive actions.

Project Lead and Co-Leads:
Chris Kaiser-Bunbury, John Dupré – *University of Exeter*
Jane Calvert – *University of Edinburgh*

Project Partner Organisations:
Alexandra Daisy Ginsberg Ltd

University of Exeter · THE UNIVERSITY of EDINBURGH · POLLINATOR PATHMAKER · ALEXANDRA DAISY GINSBERG

ESCAPE:
Engaging science and the creative arts to prepare for eruptions

Understanding the behaviour of volcanoes is hampered because we cannot see directly what is happening underground. As a result, expert opinions during a crisis are often contradictory.

The ESCAPE project aims to apply techniques from participatory theatre to resolve the contradictions, using the restless Campi Flegrei volcano, near Naples in Italy, as a case study.

The results will have real-world application to forecasting eruptions; they will deliver a template for embedding interdisciplinary thinking into evaluating incomplete information and, by combining artistic and scientific creativity, they will forge new understandings of the world around us.

Project Lead and Co-Leads:
Christopher Kilburn – *University College London*
Niamh Dowling – *RADA*
Amy Donovan – *University of Cambridge*
Carmen Solana – *University of Portsmouth.*

Project Partner Organisations:
INGV-Osservatorio Vesuviano, University of Naples, Archè Teatro.

Holistic optical biomarkers to transform dementia diagnosis

The project will investigate a new laser-based test that could revolutionise dementia diagnostics.

The novel laser-based technology will generate a 'biochemical fingerprint' from a single drop of blood or saliva. It will give an accurate diagnosis and distinguish between different types of dementia potentially years before symptoms become apparent.

The test will help identify patients eligible for drug treatments at the point when they will be the most effective. The test offers a fast, scalable and cost-effective solution to a challenge affecting millions worldwide and could transform the landscape of dementia diagnostics.

Project Lead and Co-Leads:
Christopher Kipps – *University Hospital Southampton NHS Foundation Trust*
Sumeet Mahajan – *University of Southampton*

Project Partner Organisations:
University College London, Indiana University, University of Cambridge, Wasatch Photonics, University of Gothenburg, University of Girona

NHS University Hospital Southampton NHS Foundation Trust

University of Southampton

HIDDEN SAND: Holistic investigation of the distribution, extraction, and networks associated with sand

The contemporary world is built on sand and it is now the second most consumed natural resource after water. The complexity of sand as a commodity means that there is no end-to-end oversight of the supply chain and the lack of oversight and control has fuelled exploitation and criminal activity.

The HIDDEN SAND project will bring together an interdisciplinary team to develop a novel Digital Twin framework that will capture all the relevant physical, social, economic, cultural and emotional components of the sand system. High-tech survey and remote sensing approaches, socio-economic and ethnographic surveys and practice based art will deliver a whole-system understanding of the costs, benefits and trade-offs involved with the extraction and trade of sand.

HIDDEN SAND will give a voice to local populations whose environments, livelihoods, cultural practices, and overall well-being have been impacted by the sand trade.

Project Lead and Co-Leads:
Julian Leyland, Stephen Darby – *University of Southampton*
Laurie Parsons, William Jamieson – *Royal Holloway, University of London*
Alexandra Antonopoulou – *University of the Arts London*

Project Partner Organisations:
United Nations Environment Program, WWF-Asia Pacific,
Jeronimo Art Curation Cambodia, British Embassy Phnom Penh

Developing a skeletal muscle model of glucose metabolism on responsive elastomer nanofibers

People with diabetes are unable to regulate their blood sugar levels, which are normally controlled by the hormone insulin. This can result in serious medical complications, including blindness and strokes. The main site of glucose uptake in the human body is skeletal muscle, however, over time skeletal muscle no longer responds to insulin rendering the therapy ineffective.

Due to the mechanical instability of cultured muscle fibers there is not a satisfactory model for the glucose uptake process. This project will develop a 3D-coculture system, combining human stem cell-derived muscle fibers and nerve cells, to investigate insulin responses in muscle. A scaffold of aligned elastic nanofibers will guide and stabilise the growth of the muscle fibers. The 3D muscle tissue model will allow genetic probes and electrochemical sensors to measure insulin responses.

Understanding the underlying mechanisms that prevent glucose uptake will lead to the development of pharmacological and genetic treatments for type 2 diabetes.

Project Lead and Co-Leads:
Ivo Lieberam – *King's College London*
Daniel Fazakerley – *University of Cambridge*
Wenhui Song – *University College London*

BeefTwin: AI powered digital twin for sustainable beef farming to transform the beef value chain

The *BeefTwin* project will revolutionize the entire UK beef farming ecosystem by introducing an AI-powered Digital Twin that models not just individual cattle but the entire farming system.

The technology will provide real-time insights into methane emissions, feed efficiency, and farming practices, enabling holistic, data-driven decision-making. The impact will be far-reaching—reducing greenhouse gas emissions, improving beef quality, boosting farm profitability, and enhancing animal welfare.

By transforming the farming ecosystem, *BeefTwin* will promote sustainable practices that will strengthen the socio-economic and environmental resilience of UK beef farming.

Project Lead and Co-Leads:
Xiao Ma, Fatima Gillania – *Nottingham Trent University*
Rebecca Fisher – *Royal Holloway, University of London*
Louise Manning – *Lincoln University*
Ellen Nisbet – *University of Nottingham*
Jungong Hana – *University of Sheffield*

Project Partner Organisations:
NTU Home Farm, Kinnordy Estate, Microsoft Research

Building a predictive model of all plant and animal life on earth

This project is developing a model of the planet called "Terra" that will be able to make predictions for a great many rare plant and animal species on which we currently have only sparse data.

It will also enable monitoring of biodiversity at much higher resolution and accuracy than is currently possible, to help avert the extinction crisis.

The project brings together a team of computer scientists, plant scientists, ecologists and physicists to build a suite of critically important predictions about life across our planet for extinction risks and where and how these might be most efficiently mitigated. The Terra model will be combined with world data, such as food supply chains, to identify threats to biodiversity to provide vital information to policy makers to understand impact of food production and consumption.

Project Lead and Co-Leads:
Anil Madhavapeddy, Srinivasan Keshav, David A. Coomes, Andrew Balmford, Michael Dales, Sadiq Jaffer, Tom Swinfield – *University of Cambridge*
Neil Burgess – *UNEP- World Conservation Monitoring Centre*

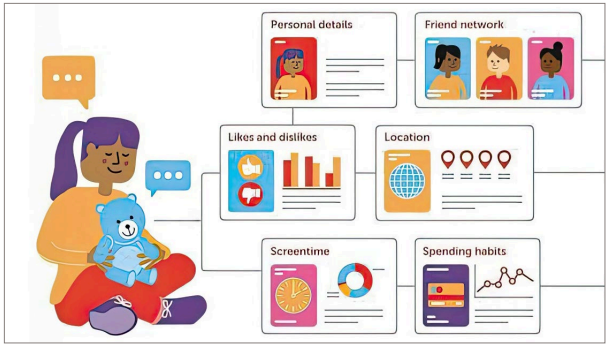
Project Partner Organisations:
Mantle Labs Ltd, Royal Botanic Gardens Kew, Stockholm Environmental Institute

GRASPING DATA: Co-creating physicalizations to empower young children to interact with, understand, and benefit from their personal data

The Grasping Data project will change how we think about children and their personal data. It will go beyond current emphases on protection and privacy to explore how children of 3 to 8 years might first understand, enjoy, and value their personal data, such as their age, location, and preferences to how active, talkative, or playful they are.

We will achieve this by working together closely with children, their parents and educators, and bringing together diverse research expertise including early learning, ethics, data visualization and engineering, to co-develop new ways to physically represent personal data that children can touch, explore, talk about and learn with.

Children will better understand their data-saturated world and have greater confidence that they should and can play a role in the design of their futures.



Project Lead and Co-Leads:
Andrew Manches, Ayça Atabey, Cara Wilson, Uta Hinrichs, Lydia Plowman – *University of Edinburgh*
Stephen Brewster – *University of Glasgow*

Project Partner Organisations:
SSERC, Edinburgh Zoo, Glasgow Science Centre.

Sensing on urban noise: distributed sensing for collaborative and sustainable cityscapes and living environments

Unused legacy optical fibre cables can be used as a cheap method for urban monitoring, sensing vibrations and sound through Distributed Acoustic Sensing technologies. Recent proposals have been made to expand the technology's use to monitor traffic, crowds, buildings' integrity, and transportation networks and could lead to smarter urban development.

However, there are important concerns around data privacy, AI ethics, equitable technology access, sustainability, climate impact, social inequality, and citizen participation in decision-making processes.

This project integrates citizen participation early in the process of technology development to guide decisions democratically and ensuring that the research benefits are aligned with societal needs.

Project Lead and Co-Leads:
Rafael Mestre, Mohammad Belal, Alexandra Anikina, Dianna Smith, Matt Ryan – *University of Southampton*
Ceri Davies – *National Centre for Social Research*

Project Partner Organisations:
National Oceanography Centre, National Centre for Social Research

Converting historical knowledge into sustainable ocean management

Atlantic herring are a fundamentally important component of the marine ecosystem in the northeast Atlantic which collapsed in the mid-20th century.

The FiSHistory project will bring together historians and marine scientists to convert historical observations of fishers, past and present, into knowledge that will inform marine ecosystem management.

Ecologically important herring spawning areas will be identified using historical sources, mostly from the 17th to the early 20th centuries, including the writings of early modern naturalists and travellers, newspaper archives, government inquiries and the memory of living fishers. The learnings will also improve our understanding of the long-term variations in spawning activity in response to changing climates.

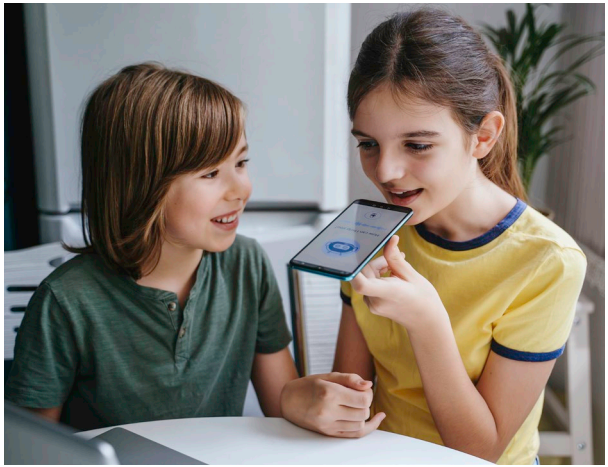
Project Lead and Co-Leads:
Alec Moore, Jan Hiddink, Shaun Evans, Lee Raye – *Bangor University*

Project Partner Organisations:
Natural Resources Wales, Isle of Man Government Department of Fisheries and Agriculture

CHAILD: Children's Agency In the age of AI

The CHAILD project aims to address the critical issue of fostering children's digital autonomy when their childhood is increasingly intertwined with Artificial Intelligence (AI) systems, such as connected toys, apps, voice assistants, and online learning platforms. While AI offers great opportunities, it also poses significant risks to children's autonomy and agency.

CHAILD will bring together a world-leading team of computer scientists, learning scientists, social scientists, philosophers, and public policy partners to define what agency means for children in the digital age. It will develop new AI systems that empower children with controls and co-produce actionable design and policy guidelines with key stakeholders in this space.



Project Lead and Co-Leads:
Nigel Shadbolt, Jun Zhao, Carina Prunkl – *University of Oxford*
Manolis Mavrikis, Wayne Holmes – *University College London*

Project Partner Organisation:
Baroness Beeban Kidron

Feeling the untouchable: Haptic touch experiences for naturalistic learning

As we confront the global sustainability challenges of our time, schools need to address the issue of disassociation with the natural world that is part of modern culture.

This project will co-design new and inclusive touch-based teaching methods that include digital haptic experiences to engage students in personally relevant, immersive and multimodal explorations of the natural world. These will help children in constructing conceptual models, while creating cognitive and affective connections between science curriculums and issues of societal relevance.

Improving teaching methods through touch could lead to meaningful integration of technology into nature-based curricula, increasing the complexity in children's observations and understandings of the natural world, and ultimately, actions to support the planet.

Project Lead and Co-Leads:
Advaith Siddharthan, Lisa Bowers, Nirwan Sharma, Stefan Ruegers – *The Open University.*
Poppy Lakeman Frase – *Imperial College London*
Andrew Manches, Laura Colucci-Gray – *University of Edinburgh*

Project Partner Organisations:
Learning for Sustainability SCOTLAND, Sight Scotland

When Memories Come Alive: An interdisciplinary study of the vividness of memory

What does it feel like to have a memory? Surprisingly little is known about how we can vividly relive past events, which functions of the brain are involved, and how these processes vary across individuals, societies and cultures.

This project is an interdisciplinary study of the human experience bringing together psychology, cognitive neuroscience, literary studies and history.

It will drive a step-change both in understanding memory vividness and the associated brain mechanisms across the life-course, and in enhancing the interpretation of vividness in literary and historical works dating back to the early modern era.

Project Lead and Co-Leads:
Jon Simons, Alexandra Walsham, Raphael Lyne – *University of Cambridge*
Charles Fernyhough – *Durham University*

UNIVERSITY OF CAMBRIDGE

Durham University

ANIMATING MINDS: Triangulating the age-appropriate impact of children's media

How can we know whether a cartoon is "age-appropriate" for young children to watch? Currently we rely on the craft intuitions of animators minimally informed by child development to create appropriate content for children of different ages.

As childhood media experiences proliferate, we need methods for directly testing and predicting the impacts of media content.

The Animating Minds project will bring together a unique team of animators, developmental neuroscientists, computer scientists and media theorists to develop a computational tool for predicting the direct impact of videos on child cognition at different ages.

Project Lead and Co-Leads:
Tim J. Smith, Mick Grierson – *University of the Arts London*
Rachael Bedford – *Queen Mary University of London*
Paul Taberham – *Arts University Bournemouth*
Paola Pinti – *Birkbeck, University of London*
Sergio Benini – *University of Brescia*

Project Partner Organisations:
Beakus, Plastic Milk, Early Years Alliance, Animation UK, Sandbox Kids, BlueZoo, Children's Media Foundation

Justice, Energy, Demand flexibility and AI for sustainability (JED-AI)

Can AI help build people's capacity to benefit from more flexible forms of energy use?

Low Carbon Technologies , such as solar panels, electric vehicles, heat pumps, smart energy-efficient appliances and AI-driven energy management solutions, are a key part of the transition to Net Zero.

Previous large-scale studies, however, have shown increasing divides in household capabilities, across income, age, and home ownership groups, to adapt quickly to these technologies.

JED-AI will integrate engineering and social science analyses to co-design AI-driven recommendations for energy demand flexibility, enabling more informed choices and contributing to a smarter, fairer and more sustainable transition to Net Zero.

Project Lead and Co-Leads:
Vladimir Stankovic, Lina Stankovic – *University of Strathclyde*
Philipp Grunewald, Charlie Wilson – *University of Oxford*
Tom Hargreaves – *University of East Anglia*

Project Partner Organisations:
Energy Systems Catapult and Hugo Technologies Limited

Satellite-Aided Technologies for Guarding energy services under climate hazards, risks, and disasters (SAT-Guard)

The transition towards a sustainable energy system in the UK requires a comprehensive, equitable, and inclusive strategy that considers the environmental, economic, and social aspects of future energy systems. The power grid is increasingly vulnerable to climate-related hazards such as storms, which pose a significant risk to the continuity of power supply and our communities.

The SAT-Guard project aims to address multifaceted challenges through the development of innovative satellite-aided mechanisms designed to proactively manage power grids. The system will enable flexible and socially-conscious energy management, and ensure swift and efficient power supply restoration following climate-related hazards. SAT-Guard seeks to pioneer a path towards a resilient, equitable, and sustainable energy future for the UK.

Project Lead and Co-Leads:
Hongjian Sun, Bruce Malamud, Simone Abram, Daniel Donoghue, – *Durham University*
Jing Jiang, Eamon Scullion – *Northumbria University*

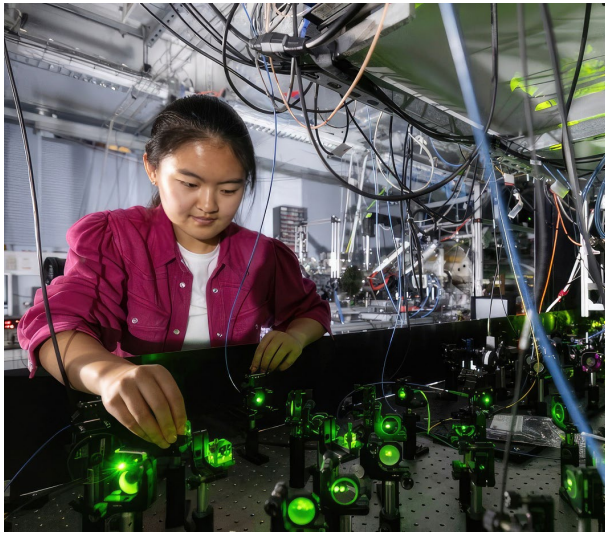
Project Partner Organisations:
Northern Gas Networks, Mithrasol Energy, Moxie Energy Group and FutureZero Consulting

Testing fundamental physics using arrays of ultracold molecules

There is virtually no antimatter in the visible Universe. This asymmetry between matter and antimatter is one of the greatest mysteries in science and points to new forces yet to be discovered. Because they violate a symmetry, these new forces give electrons inside molecules an asymmetric shape.

The interdisciplinary research team brings together expertise from particle physics and quantum science that will allow molecules to be cooled to near absolute zero so that they are still enough to measure.

The advancement of state of the art precision quantum measurement and the analytical tools will influence new theories of physics.



Project Lead and Co-Leads:
Michael Tarbutt, Oliver Buchmueller, Jongseok Lim and Ben Sauer
– *Imperial College London*

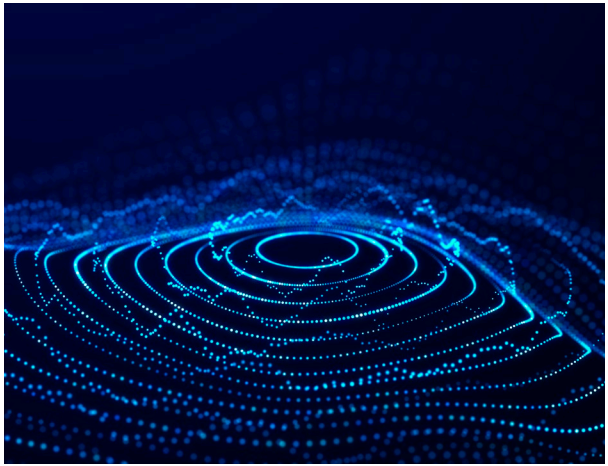
IMPERIAL

Sonic Intangibles: sonification hub for innovation in sound and meaning

Sonification is a method of representing data through sound that can bring the intangible, such as distant galaxies, computer network traffic, the Earth's magnetosphere, or the quantum states of materials into our audible experience.

The project brings together computer scientists, musicians, observational astronomers, mathematicians, and materials scientists and will establish sonification as an interdisciplinary practice that can be widely utilised for exploring data, representing intangible data and phenomena, and providing new embodied experiences through sound.

The project will lay the foundations of a UK interdisciplinary hub that leads the global agenda in sonification research and, through public concerts, installations, talks, and workshops, will foster public understanding of sonification's potential.



Project Lead and Co-Leads:
Paul Vickers, Daniel Ratliff, Lucy Whalley – *Northumbria University*
Christopher Harrison, Bennett Hogg – *Newcastle University*

Project Partner Organisations:
Orbyts

LOCAST: Enabling Low-Carbon Structures by Understanding Human Effects of Motion

Tall buildings currently use far more material than needed for safety, especially carbon-intensive concrete and steel. This is to ensure occupants don't feel any sway motion, even in strong winds.

The LOCAST project questions this approach by rigorously measuring, for the first time, what sway motion building occupants can feel, and how this affects their wellbeing and workplace performance.

The project will also mechanistically assess the role of physiology in how motion affects people. The aim is to inform next generation design guidance for future lower carbon buildings.

Project Lead and Co-Leads:
Ian Walker – *Swansea University*
Antony Darby – *University of Bath*
Jennifer Davis, Cathy Holt – *Cardiff University*
Alexander Pavic – *University of Exeter*

Learning molecular trajectories of pulmonary hypertension patients

Pulmonary Hypertension (PH) is a complex disease that is associated with a range of diseases and causes, such as molecular, life style and environmental, that can change over time and leads to poor prognosis.

The project aims to use machine learning and longitudinal molecular data to predict the progression of PH. By combining clinical, molecular, and time-series data, we will develop robust models to forecast future symptoms and molecular changes in patients.

This interdisciplinary approach, integrating medicine, biology, epidemiology, and engineering, has the potential to improve diagnostics, identify new biomarkers, and enable more cost-effective and personalized treatments for PH and other complex diseases.

Project Lead and Co-Leads:
Dennis Wang, Allan Lawrie, Martin Wilkins – *Imperial College London*
Mauricio Alvarez – *University of Manchester*
Varsha Gupta – *A*STAR IHDP (Singapore)*

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IHDP

Interdisciplinary systematic review: mechanistic evidence and epistemic justice

What is the best way to evaluate whether an intervention works? Traditional 'evidence-based' evaluation methods take into account particular types of studies, especially randomised trials, but exclude other relevant evidence, such as mechanistic studies and views of stakeholders. The assumption that randomised trial evidence can stand alone led to untrustworthy conclusions about the efficacy of masks during the COVID-19 pandemic.

This project will develop a broader approach to evidence review, one that includes a diverse range of evidence from across disciplines. The new methods promise better informed evaluations that take stakeholder evidence into account, improving how interventions and policies are implemented. A new review of the effectiveness of face-mask mandates will be used to test the approach.

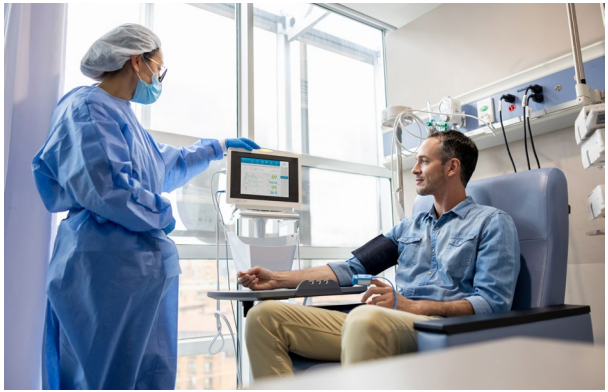
Project Lead and Co-Leads:
Jon Williamson – *University of Manchester*
Trish Greenhalgh – *University of Oxford*
Rebecca Helm – *University of Exeter*

High resolution molecular profiling platform to investigate the role of tumour microbiota in anti-tumour immunity

Increasing research shows that cancer development and responses to treatment, such as immunotherapy, are linked to each patient's unique tumour microenvironment.

This project will harness advanced imaging and molecular techniques, AI-driven image analysis, and bioinformatics tools to map the biological processes driving ovarian cancer. New microfluidic methods will be used for in-depth scrutiny of the intratumour microbiome. Together, these approaches will enable a highly holistic view of cancer cell biology with high spatial resolution and detailed molecular information.

Finding ways to predict which patients respond to immunotherapies and the development of new therapies to revert immunosuppression could be a game changer for the treatment cancer patients.



Project Lead and Co-Leads:
Huabing Yin, Sara Zanivan, Umer Zeeshan Ijaz – *University of Glasgow*
Josephine Bunch – *National Physical Laboratory*
Wei Huang – *University of Oxford*

Project Partner Organisations:
University of Leicester, Beatson West of Scotland Cancer Center

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