Durham University

Global Research

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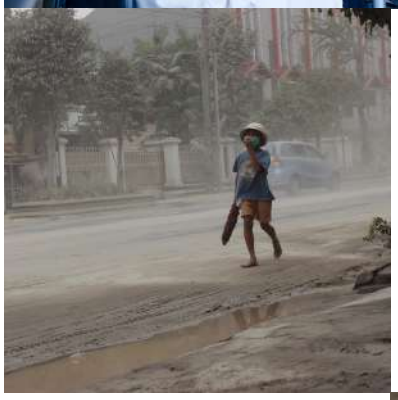


Research to empower and inspire

We are a globally outstanding centre of research, teaching and learning excellence, a collegiate community of extraordinary people, in a unique and historic setting. Durham is a university like no other.

We conduct innovative and impactful research to transform lives and make a difference, globally and locally: research to empower and inspire.

Among our scientists, social scientists, business, arts and humanities scholars we have world-leading authorities in their field. From child development to the future of the planet; from the fundamental elements of life to seeing further into space and time than ever before; we are shaping the world, from the intimate to the infinite.

We are a world top 100 university in the QS World University Rankings and top 20 for sustainability in the QS World University Rankings for Sustainability 2024.

Our academic community conducts forward-thinking, interdisciplinary research that harnesses disciplines and has impact on communities all over the world. We value international collaboration as central to enhancing global knowledge and citizenship, such as our partnerships with the Palace Museum in Beijing and the African Research Universities Alliance, as well as our memberships of the Matariki Network of Universities and RENKEI consortium.

I hope you will enjoy this selection of Durham's research contribution to society.

Professor Karen O'Brien
Vice-Chancellor and Warden

"We believe that inspiring our people to do outstanding things at Durham enables Durham people to do outstanding things in the world."

Durham in numbers

Among Europe's

top 30

universities

(27th, QS World University Rankings: Europe 2024)

A world

top 100

university

(78th, QS World University Rankings 2024)

19

subjects in the world top 100

(QS World University Rankings by Subject 2023)

Top 20

in the world for sustainability

(QS World University Rankings for Sustainability 2024)

A UK

top 10

university

(Guardian University Guide 2024, The Times/ Sunday Times Good University Guide 2024, Complete University Guide 2024)

90%

of research rated 'world-leading' or 'internationally excellent'

(UK Research Excellence Framework 2021)

Triple-accredited Business School

(Association to Advance Collegiate Schools of Business, Association of MBAs, EFMD Quality Improvement System (EQUIS))

England's third oldest university

(founded 1832)

A collegiate university

(17 distinct college communities)

Around

21,500

students

Over

330

undergraduate and postgraduate courses

£85m

Research awards made to Durham (2022/23)

A world top 100 university

We are a world-leading university, with 12 of our subjects ranked in the world top 50 and 19 in the world top 100.

Experts examine a text in Palace Green Library


Students in a Geography laboratory


Students undertake a breath test in a Human Performance laboratory


Students in a Music studio


Student in Theology and Religion seminar

We conduct innovative and impactful research to transform lives and make a difference, globally and locally: research to empower and inspire.

We are focused on sustainable development and actively contributing to the United Nations Sustainable Development Goals. In the QS World University Rankings for Sustainability 2024, we ranked 19th. Our sustainability research excels in areas including energy systems, hydrogen development and exploration, carbon capture and storage and environmental justice.

We nurture world-leading and world-changing scientific research across diverse fields, including: surface chemistry; plant and soil science; hazard and risk, including natural hazards and infrastructure; and physics – including computational cosmology and particle physics. Recently, two of the world's most prestigious academic journals, Science and Nature, simultaneously featured Durham research on their front pages – from our Biosciences and Physics departments, respectively.

We are dedicated to pursuing social justice, undertaking fearless research that leads to policy and societal change and reform. In Social Sciences and Health, we have leading voices in the investigation of violence and abuse, climatology and urban sustainability, anthropology, where we span social, evolutionary and health anthropology, and archaeology, including the protection of heritage in the face of humanitarian or environmental crisis.

Arts and Humanities at Durham, which is among the top 50 in the world, is characterised by a commitment to global reach and historic depth, combining tradition and innovation to yield outstanding success across our departments. From classics to contemporary literature, from African history to Iberian and Latin American art, from Chinese culture to Catholic studies, from medieval libraries to machine learning and artificial intelligence, our transformative approach incorporates medical, digital and environmental humanities, and path-breaking research in culture, creativity and heritage.

We are at the heart of Durham's UNESCO World Heritage Site, a place of learning for over a thousand years, and internationally significant libraries and collections. With one of the world's largest and most diverse concentrations of medieval and early modern studies, it makes our home a laboratory for global heritage.

We have an international triple-accredited Business School, and one of the longest established in the UK. Our business scholars are changing how we understand leadership, accountability, sustainability, supply chains, financial inclusion, financial technologies, banking, economic theory and environmental economics.

> **Read more here:**
https://bit.ly/3vl1j4T

Towards a better future

We are one of the top universities in the world for taking action to address the most pressing environmental, social and governance challenges facing society today.

A cyclist next to the Nyhavn Canal, Copenhagen

Addressing global climate change

We are always developing new research to shape a better future for people and our planet.

We have signed the United Nations Sustainable Development Goals (SDG) Accord, where we pledged our commitment to one another to do more and create a better world by ending poverty, fighting inequality and addressing the urgency of climate change.

Professor Harriet Bulkeley, in our Department of Geography, is leading pioneering research which is at the forefront of addressing global climate change, exploring how cities can respond to this challenge through innovative solutions to reduce energy and increase nature in urban areas.

This research is significantly informing global climate change governance. Bodies such as the Organisation for Economic Co-operation and Development, the International Energy Agency, and the World Bank have embraced and incorporated this research into their work. The UN-Habitat's Guiding Principles for City Climate Action Planning is a testament to the research and its real-world application internationally.

This structured framework can be used by cities across the globe to develop and implement robust climate action strategies. Our research in this area shows that urban climate governance is complex and multifaceted, and a vital arena for instigating the transformative changes required to address issues of global climate change.

> **Read more:**
https://bit.ly/3Sa4ntw

A person wearing a face mask to protect from volcanic ash
Photo credit: Tri Wahyudi

Protecting our communities through Earth Sciences

We are living through a time of unprecedented change on Earth. Scientific understanding of geological hazards, sustainability, infrastructure, climate change, energy, and natural resources has never been so important. Earth and environmental sciences sit at the heart of the solution.

Research led by Professor Claire Horwell, in our Department of Earth Sciences and Institute of Hazard, Risk and Resilience, is helping communities living near active volcanoes, and the agencies protecting them, to reduce exposure to volcanic emissions. Our research led to the co-development of global and community specific advice to prevent breathing problems and other illnesses caused by a volcanic eruption.

When volcanic ash falls on a community, immediate concerns arise about air quality and self-protection. Traditional health assessments take time, but swift decisions are necessary. A team from our Department of Earth Sciences developed a range of physicochemical techniques for rapidly assessing the characteristics of volcanic ash, so quicker decisions can be made to reduce exposure to harmful emissions.

The Heath Interventions in Volcanic Eruptions (HIVE) project subsequently focused on effective respiratory protection for community use.

Researchers tested the effectiveness of a range of cloths (e.g. handkerchiefs, shawls, hijabs) and facemasks/respirators in providing protection against volcanic ash, finding industry-certified devices, such as N95 masks, provided the best form of protection.

As a direct result of this project, 75,000 N95 masks were distributed in Bali by Mt Agung Relief (a non-governmental organisation). The study findings were incorporated into public information, co-developed with Indonesian agencies and endorsed by the World Health Organisation (WHO), showing how people could protect themselves from inhaling ash and how to properly fit a facemask.

Additionally, the ash analysis protocols were incorporated into New Zealand governmental policy on volcanic eruption response.

> **Read more:**
https://bit.ly/3TOr7kf

Delivering solutions for industry

A collaboration between Durham University and Amrita Vishwa Vidyapeetham (Amrita University) has tackled some of the biggest challenges being faced by industry.

Foundation industries, integral to the economies of India and the UK, are exploring decarbonisation, energy optimisation, and sustainability. The UK-India FI-SusTEM Collaboration, led by Durham, has exploited world-leading research and development in innovative thermal energy management and waste heat utilisation solutions.

The collaboration focuses on optimising production processes, enhancing energy efficiency, and reducing costs, coupled with the innovative capture and utilisation of waste heat innovations.

> **Read more:**
https://bit.ly/3TTeEf3

Factory chimneys

Two schoolchildren running into a school building

Pioneering education toolkit benefits disadvantaged children

Researchers in our School of Education have developed a pioneering evidence toolkit to ensure funding for pupils, and especially disadvantaged children, is spent in the most effective way — reducing inequalities in schooling and improving children's learning outcomes.

The Teaching and Learning Toolkit helps schools in the UK and globally to decide how to make the most of funding they are allocated by government.

The Toolkit, hosted and supported by the Education Endowment Foundation, provides schools with free online summaries of research so teachers and other education professionals can best use their resources to improve children's learning outcomes.

The Toolkit is underpinned by a review of the highest quality studies, synthesising research findings on 46 education topics, summarised by:

- Average impact on pupils' attainment;
- The strength of the evidence; and
- The cost of implementing within a school.

The Toolkit was also identified as a model for the 'What Works' network for social policy, which has informed over £200 billion of UK Government spending.

It is now being used by schools across the world, having been translated into Arabic, Catalan, Portuguese and Spanish and has been beneficial in the education systems in Australia, Chad, Jordan, Spain and across Latin America.

Future plans will see the adaptation of the Teaching and Learning Toolkit for teachers in Wales, Belgium and the Netherlands.

The Toolkit is a live resource which is updated on a regular basis, ensuring that all schools can benefit from up-to-date research in education.

Fast facts

Approximately 15,000 schools with more than five million children and young people in England have used our Teaching and Learning Toolkit.

> **The Toolkit** is available here https://bit.ly/4aSu3Cz

Tackling low-waged and insecure work through global policy

Pioneering research by our world-renowned Law School has directly influenced global and domestic legal policy on unacceptable forms of work, offering greater protection for labour forces in low-waged and insecure work.

Professor Deirdre McCann carried out ground-breaking research which has changed the shape of legal regulation and policy for a global workforce.

Drawing on her extensive research on precarious work and labour standards in low-income countries, Professor McCann has developed a model which integrates effective regulation with global efforts to achieve the United Nations Sustainable Development Goals (SDG) of decent work and economic growth.

The model allows policymakers to identify key features of unacceptable work such as low wages, long hours, underemployment, and the magnitude of these risks. It also highlights effective regulatory interventions. The model is designed to be applicable globally.

The Unacceptable Forms of Work project made a core contribution to the UN legal policy through the work of the International Labour Organization.

Her pioneering research has had a crucial influence at a country level by providing a framework for effective interventions on unacceptable work in Benin, Bolivia, Brazil, Costa Rica, India, Malawi, Morocco, Pakistan, Pacific Island countries, southern Africa, Thailand and Uzbekistan.

Additionally, the research has influenced employment policy in China, Indonesia, Mozambique, the Philippines, South Africa, and Uganda and policy and legal reforms on insecure work and gender equality in Australia.

> **Read more:**
https://bit.ly/41OVPM4

Factory workers in Cape Town
Photo credit: Mlondolozi Mbolo

Rethinking value creation for sustainable business

Our Business School delves into the need to rethink value and how companies generate wealth while contributing to sustainable development.

Research led by Professor Carol Adams, from our Department of Accounting, emphasises the crucial role of incorporating sustainable development considerations into corporate reporting, which can lead to greater value creation for organisations and their stakeholders and better outcomes for society, and the environment.

Professor Adams has developed a five-step approach to prompt organisations to identify risks and opportunities arising from sustainable development issues, and to contribute to the Sustainable Development Goals (SDG) whilst also creating value for the organisation and its stakeholders.

Her ground-breaking research has achieved the following:

- Influenced businesses, asset owners and policymakers, and has been disseminated through framework-setting bodies and professional accounting bodies;
- Instigated change in policy and regulatory body guidance, increasing the emphasis on reporting on sustainable development issues;
- Effected change in reporting practice and strategies informing investment decisions; and
- Been adopted by the UN Development Programme in its SDG Impact Standards.

> **Read more:**
https://bit.ly/41STm3c

A classical revival

Teenagers handling ancient artefacts

Classics education has recently surged in popularity in state schools in the UK. At the forefront of this revival is Professor Arlene Holmes-Henderson MBE, an award-winning professor in our Department of Classics and Ancient History.

Classical education in the UK, once limited to a small number of elite schools, has expanded in recent years.

Professor Holmes-Henderson's research highlights the importance of widening access to Classics and has contributed to more young people studying ancient history and classical civilisation at ages 14 and up across England.

Secondary school Classical Civilisation examination (GCSE) entries entries are up by 27% and are at their highest number for 20 years. Entries for post-16 A Level examinations in Ancient History are at the highest level since the qualification launched and have seen a 22% increase from 2022 to 2023.

In co-founding Advocating Classics Education (ACE) with Professor Edith Hall, she has worked tirelessly to support state schools in bringing Classics back into the classroom. She now advises the UK Department for Education, as Chair of the Latin and Classics Expert Panel. Her research informs policy thinking in languages and humanities and boosts the evidence base on which ministers make decisions about funding for schools and colleges.

Professor Holmes-Henderson's research demonstrates that studying the languages and cultures of the Greeks and Romans also helps young people to cultivate transferable skills, such as effective argumentation and communication.

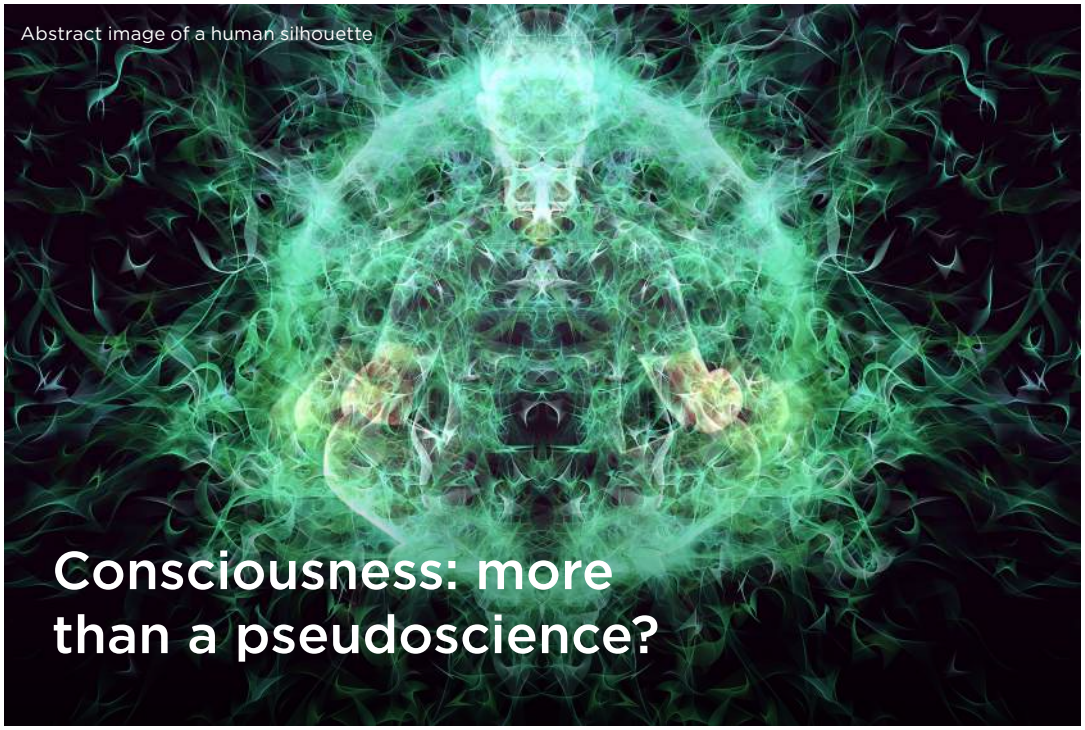
She asserts that oracy is a crucial life skill but one that is currently not taught in all schools, meaning a child's skills in this area are often determined by their family background or the school they attend. Her solution includes introducing rhetoric and oracy lessons.

Fast facts

Entries for post-16 A Level examinations in classical civilisation rose by

36% for 2023

> **Watch** more on Arlene's policy engagement work


Abstract image of a human silhouette

Consciousness: more than a pseudoscience?

A leading theory in consciousness has been branded 'pseudoscience'.

Integrated information theory (IIT) aims to give mathematically precise conditions for when any system – a brain or some other lump or matter – is or is not conscious.

IIT is being hotly contested – some accuse it of being pseudoscience, whilst others leap to its defence. Yet all in the debate are united by a desire to ensure the credibility of consciousness science.

Professor Philip Goff, in our Department of Philosophy, takes the question head-on of why it's so hard to make progress on consciousness. The core difficulty, he argues, is that consciousness defies observation.

Science does deal with things that cannot be observed, such as fundamental particles, quantum wave functions and maybe even other universes.

However, consciousness poses an important difference: in all other cases, we theorise about things we can't observe to explain what we can observe. Uniquely with consciousness, the thing we are trying to explain cannot be publicly observed.

Instead, consciousness is known about privately, through the awareness each of us has of our own feelings and experience. As a result, it's very hard to experimentally demonstrate which theory of consciousness is correct. The benefit, in contrast to other scientific phenomena, is we have direct access to the phenomenon, and our direct access may provide insights into its nature.

Crucially, to accept that our knowledge of consciousness is not limited to what we can glean from experiments is to accept that science and philosophy need to work hand in glove to crack the mystery of consciousness.

> **Read more:**
https://bit.ly/41Q6HsY

Helping shape the future of the global Catholic Church

Professor Anna Rowlands, from our Department of Theology and Religion, is a leading political theologian whose research expertise includes issues such as forced migration, political theory and Catholic social thought. She is helping shape the future of the global Catholic Church.

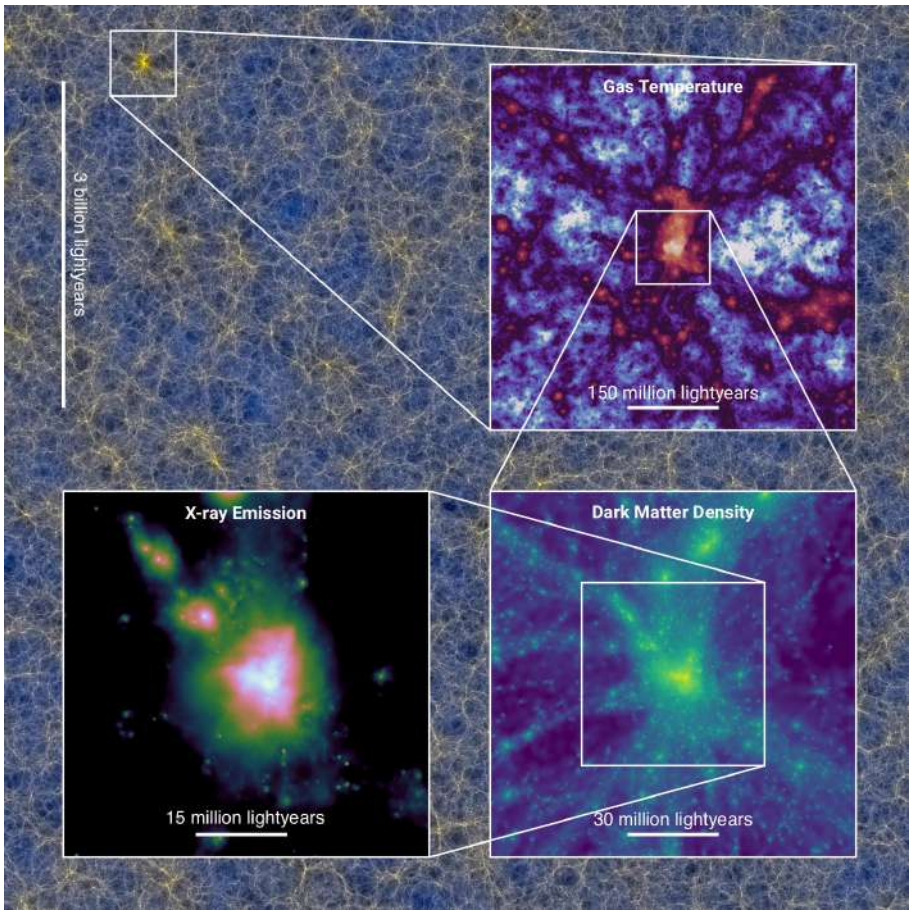
Professor Rowlands was selected for a secondment to the Vatican, contributing her expertise to the General Secretariat of the Synod, and the Dicastery (Department) for Integral Human Development of the Holy See (Vatican).

Her role includes working closely with the team managing the global Synod process established by Pope Francis. She is working to support the core research work of the Holy See department that speaks on matters of politics, economics, climate, and migration.


Anna Rowlands

Biggest ever supercomputer simulation to investigate the Universe

As part of an international team of astronomers, we have carried out the biggest ever computer simulations from the Big Bang to the present day to investigate how the Universe evolved.



This background image shows the present-day distribution of matter in a slice through the largest FLAMINGO simulation, which is a cubic volume of 2.8 Gpc (9.1 billion lightyears) on a side. The insets show three consecutive zooms centred on the most massive cluster of galaxies; in order, these show the gas temperature, the dark matter density, and a virtual X-ray observation (Figure 1 from Schaye et al. 2023).
Photo credit: Josh Borrow, the FLAMINGO team and the Virgo Consortium. Licensed CC-BY-4.0

The FLAMINGO simulations, carried out on the Cosmology Machine supercomputer at Durham over the past two years, calculate the evolution of all the components of the Universe. This includes ordinary matter, such as stars and planets, dark matter and dark energy – based on the laws of physics.

As the simulations progress, virtual galaxies and galaxy clusters emerge in precise detail.

It is hoped that the simulations will allow researchers to compare the virtual Universe with observations of the real Universe being captured in more vivid detail than ever through new high-powered telescopes, like the James Webb Space Telescope – which Durham University played a part in developing.

This could help scientists understand if the standard model of cosmology, used to explain the evolution of the Universe, provides an accurate description of reality.

Previous simulations, which have been compared to observations of the Universe, have focused on cold dark matter which is believed to be a key component of the structure of the cosmos.

However, astronomers now say that the effects of ordinary matter, which makes up only 16% of all matter in the Universe, and neutrinos, tiny particles that rarely interact with normal matter, also need to be considered when trying to understand the Universe's evolution.

The FLAMINGO simulations have tracked the formation of the Universe's structure in dark matter, ordinary matter and neutrinos, following the standard model of physics.

The FLAMINGO simulation is being run on Cosmology Machine 8 (COSMA 8), which has the power and memory of 17,000 personal computers.

With these exceptional tools, our research will continue to inform and enrich our understanding of the Universe.

> **Read more:**
https://bit.ly/3Hf50fj and find out about our Institute for Computational Cosmology: https://bit.ly/3NUMKLQ

Fast facts

Hosted at Durham University on behalf of the UK's DiRAC High-Performance Computing facility, COSMA 8 consists of 67,584 individual processors working together to produce high-powered simulations of the Universe. It is the most powerful supercomputer dedicated to academic research in the UK for calculations requiring exceptionally large memory.

Informing global conservation strategies

Our bioscientists are playing a key role in identifying the impact of climate change on plant and animal life, providing critical insights which will help to conserve species in the future.

The research of our Conservation Ecology Group (CEG) looks at helping different species to adapt to the effects of a changing world.

The models they have created are being used around the world to inform conservation policy to help species cope with current and future climate change in a highly human-modified landscape. The CEG's species distribution and abundance models have been critical in identifying the potential impacts of future climate change on bird and tropical vertebrate species.

Our researchers have found a systematic signal of recent climate change having affected populations of both widespread and protected birds across Europe and the USA.

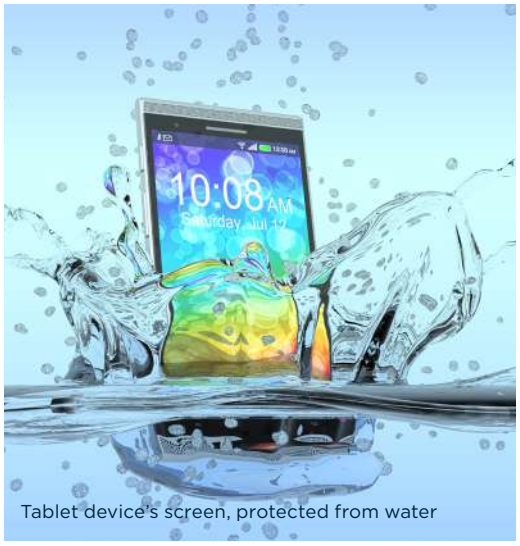
Their research showed that projected shifts in tropical species ranges will have profound impacts on their future conservation within protected area networks. Their research has also identified species that are vulnerable to climate change and might need help to colonise new areas.

They have collaborated extensively with BirdLife International, a global conservation body.

Their research has been instrumental in the retention of the EU Birds Directive and the conservation policies and strategies of EU member states. It has also impacted the UN Convention on Biological Diversity (CBD) Aichi Biodiversity Targets policy, as part of the UN Environment Programme. The model has also influenced the IUCN Guidelines for Assessing Species Vulnerability to Climate Change.

Their findings will help conservation managers and planners globally to implement changes based on better information about species' vulnerabilities to climate.

Budgies



Tablet device's screen, protected from water

The science of surfaces

Professor Jas Pal Badyal FRS, from our Department of Chemistry, is recognised internationally for his research on the functionalisation of solid surfaces and deposition of functional nanolayers for technological and societal applications.

He has led on ground-breaking research on the use of functional surfaces in everyday products, protecting billions of smartphones from water damage and tackling global environmental and health problems.

Professor Badyal's research was commercialised by companies including P2i, producers of footwear, smartphones and hearing aids.

He is a Fellow of the Royal Society, which recognises leading scientists, engineers and technologists from the UK and Commonwealth, and a Foreign Fellow of the National Academy of Sciences, India.

In 2023, Professor Badyal, in addition to his role at Durham, was appointed the Chief Scientific Adviser for Wales, responsible for developing the Welsh Government's science policy and advancing the country's research and innovation systems.

> **Watch** to find out more on Professor Badyal's work with functional surfaces.

Embracing language diversity

Failing to consider language diversity in Equality, Diversity and Inclusion (EDI) provision can cause problems for multinational firms. Our research outlines the positive impact of celebrating diversity and difference in organisations.

Despite operating on a global basis and pulling in a workforce that spans multiple continents, cultures and languages, multinational companies are often disappointed with the progress they make with regards to EDI management.

Research from our Business School demonstrates that multinational companies often struggle to produce and embed effective EDI-focused agendas. This difficulty often stems from having too narrow a focus when it comes to what matters in EDI provision. Often, policies develop on a small range of diversity dimensions which fail to include other important factors, such as language.

A lack of attention to the management of linguistic diversity is revealed to be of particular concern. Even though language-based stereotyping and discrimination are recognised barriers to work and career outcomes for minority individuals and groups, our research demonstrates that too little attention is paid to fostering linguistic diversity and inclusion in such organisations.

The research, carried out by Professor Martyna Śliwa from our Business School in collaboration with Dr Sylwia Ciuk of Oxford Brookes University and Professor Anne-Wil Harzing of Middlesex University, proposes a two-step framework for how an effective EDI agenda can be both implemented and leveraged for its strategic potential.

The first step seeks to change the way multinational companies think about diversity. Rather than viewing diversity in negative terms or seeing it as problem to overcome, differences can instead be viewed positively. Companies can recognise that multiple languages and multilingual workers are a resource and additional languages are not inferior to the dominant company language.

The second step concerns changing multinational companies' actions. Deliberate steps need to be taken to challenge expectations and norms that members of non-dominant groups – those who communicate at work in a foreign language – need to adjust to the dominant group's way of communicating.

Successful interaction should not solely depend on the level of fluency of the non-dominant language user, which puts additional pressure on colleagues and risks miscommunications occurring.

Whilst the study displays the framework as a means of managing linguistic diversity, the framework can be applied to any other area of the EDI agenda.

> **Read more:**
https://bit.ly/47nDGpO

A person listening to a translated presentation via headphones

Capping energy prices will damage climate change progress in developing countries

Developing and emerging countries will fail to make any significant contribution to global sustainability efforts unless governments stop capping electricity prices, according to research from our Business School.

Factory chimneys

Whilst global initiatives such as the Conference of Parties (COP) and United Nations Framework Convention on Climate Change (UNFCCC) conferences have been effective in pushing climate change action to the top of the political and economic agenda, there are concerns that developing nations will struggle to meet the targets agreed.

The study, undertaken by researchers at our Business School, alongside colleagues from North South University in Bangladesh and Copenhagen Business School, Denmark, has sought to find better ways to support developing nations to reduce their continued reliance on fossil fuels. The focus in developing and emerging economies remains on energy security and accessibility for all. As a result, there are distortions to the market, including controlling the price of electricity to ensure affordability for all households, and subsidising fuel costs to support energy production.

Such measures have a long-lasting negative impact on the planet, triggering higher levels of greenhouse gases and jeopardising any attempt at meeting sustainable development goals.

Our researchers have investigated how decarbonisation policies could be implemented without adversely affecting society.

To tackle the problem, Professor Laura Marsiliani and colleagues' work models how a variety of decarbonisation policies might be implemented, and which would deliver the greatest benefit to the planet without adversely affecting society.

Their research, focused on Bangladesh as a key example, is exploring ways in which the country could achieve its pledge to reduce greenhouse gas emissions by a minimum of 5% by the year 2030.

They modelled the introduction of a modest carbon tax, the removal of fossil fuel subsidies, and the elimination of price distortions on electricity. All measures were found to reduce emissions but could also provide a boost to the economy in terms of a Gross Domestic Product increase.

Such an approach would facilitate Bangladesh achieving its ambitious emissions target. What is crucial for success, the researchers say, is securing government support and commitment.

> **Read more:**
https://bit.ly/47uUfjJ

A ship transporting containers

Decarbonising ports and shipping

We are at the forefront of a research partnership aimed at creating a pioneering research hub providing technically, environmentally, socially and economically informed pathways to decarbonise the maritime sector.

We are leading the new UK National Clean Maritime Research Hub (UK-MaRes Hub) which is a partnership with Nottingham, Brighton, Birmingham, Liverpool, Cranfield, Aston Ulster, Sheffield, St Andrews, Newcastle, London City, and Southampton Solent universities. It will focus on the elimination of greenhouse gas emissions and air pollution from maritime activity in the ports and at sea.

The Hub is working with partners to explore the scale-up and safe use of sustainable marine fuels, new power and propulsion systems, decarbonised port operations and infrastructure, improved maritime operations, and vessel efficiency.

Researchers, led by Professor Tony Roskilly from our Department of Engineering, are also exploring digitisation, green finance and the potential economic and social benefits of transitioning to a cleaner maritime future.

The Hub brings together universities and over 70 industrial, civic and international organisations, including shipping companies, ports, equipment and service providers, fuel producers, and civic bodies.

A key element is the Clean Maritime Research Partnership which will work with partners across the maritime sector to co-create future research activity.

This involves the development of the Clean Maritime Network+ to share knowledge and best practice, and a Clean Maritime Policy Unit to provide advice, evidence, and briefings to inform policy.

Funders for the Hub include the Engineering and Physical Sciences Research Council (EPSRC), the UK Government's Department for Transport, consortium universities and project partners. The Hub builds on our strengths in net-zero research across areas such as energy systems modelling, hydrogen fuelled transport, carbon capture and the decarbonisation of heating and cooling.

> **Read more:**
https://bit.ly/48sCkeC


Plant samples in a laboratory

Leading the way in crop improvement research

We are home to a leading centre for crop research, with a long-standing, internationally recognised record of research excellence.

Our Durham Centre for Crop Improvement Technology brings together researchers from across disciplines to develop state-of-the-art technologies for crop improvement and protection.

Our researchers, led by Professor Ari Sadanandom, work closely with farmers, the AgriTech industry and other research centres to seek solutions to some of the most pressing issues relating to food security – in particular, addressing the impacts of climate change.

With the help of a £1m grant from the Wolfson Foundation, we are refurbishing and upgrading the Centre's plant growth facilities.

This will allow the advancement of our pioneering research into supporting food security in our changing climate.

The upgraded facilities will allow our researchers to study model plants and crops in a wide range of climatic conditions that mimic those found from polar regions to the tropics.

It will also mark a step-change in plant transgenesis capabilities, including genome editing, to link crop traits with genetics.

This will enhance our work with industry partners and farmers to apply mechanistic insights to increase the resilience and competitiveness of national and international food supply chains.

The £1m funding is also supporting the next phase of our plans for the Centre – the development of the North East Centre for Crop and Soil Innovation.

This will be a significantly expanded high-tech hub, in partnership with Newcastle and Teesside Universities and Houghall College, all in the North East of England, to accelerate the exploitation of scientific discoveries into the field to sustainably boost food production.

> **Read more:**
https://bit.ly/3tRZrjF

Backing the future: investing in tomorrow's research

We are investing in new cutting-edge research areas through our Strategic Research Fund (SRF).

Two pioneering projects receiving SRF support are the Soil Microbiome Augmentation and Restoration Technologies Lab (SMART Soils Lab) and the Durham Centre for Responsible Innovation in Space.

The SMART Lab is pioneering the development of a new field of nature-based environmental engineering of the soil microbiome, recognising the crucial importance of living soils for crop production and biodiversity.

The Durham Centre for Responsible Innovation in Space aims to become a world leader in space sustainability.

It will link space technology, policy, and the space industry to provide the first multi-disciplinary research institute capable of capturing the full research ecosystem of space sustainability.

> **Find out more about our Durham Centre for Responsible Innovation in Space:**
https://bit.ly/3NUfTH7


Space satellite
Photo credit: NASA

Global Durham

International collaboration is key to Durham's excellence in teaching and research. We have partnerships and affiliations with many institutions and organisations worldwide.

> **Read more about our global partnerships:** https://bit.ly/48lAHiS

Our Vice-Chancellor holds a collaborative flag with our partners from ZNU

Ukraine twinning partnership

As part of a large-scale twinning initiative, supported by Universities UK (UUK) and the Ukrainian Ministry of Education, we are twinned with Zaporizhzhia National University (ZNU) in Ukraine.

The twinning scheme aims to provide tangible and collaborative support to Ukrainian universities, in the short and medium term and also in the long term as the country's universities look to rebuild.

Our developing connection with ZNU also offers us both the opportunity to develop equitable research collaboration in specialist areas. We have discovered mutual interests with ZNU in areas of memory politics, post-conflict urban renewal including financial implications, mental health, legal aspects of conflict, global justice and arbitration and issues of internal displacement. Synergies are also developing between our Biosciences departments around crop production.

> **Read more:** https://bit.ly/3tImQnP

The Matariki Network of Universities

Founded in 2010, the Matariki Network of Universities (MNU) is a network of seven like-minded and research-led universities who have research, education, and benchmarking and sharing of best practice at their core.

In the Network, Durham has partnered with universities from the USA, Canada, Australia, New Zealand, Germany and Sweden. As of 2023, researchers at MNU partner universities have co-authored more than 1,000 co-publications and in total, members have exchanged over 1,200 students.

Our Vice-Chancellor and Warden, Professor Karen O'Brien, oversaw an exciting period of development during her tenure as Chair between 2022-2023. The Network has established five new principles to guide its priority activities of research, collaboration and engagement. These principles are a commitment to transnational dialogue, academic freedom and autonomy, freedom of expression, respect for diversity, critical friendship and purposeful collaboration for improving lives. Matariki, a name borrowed from the Māori language, also places considerable emphasis on indigenous research and education with schemes such as the Matariki Indigenous Student Mobility Programme.

The Network also runs a Global Citizenship Programme that provides varied opportunities for students to engage in activities relating to global citizenship and sustainability.

Matariki Executive Heads meeting in Perth, Australia

Joint working across the globe

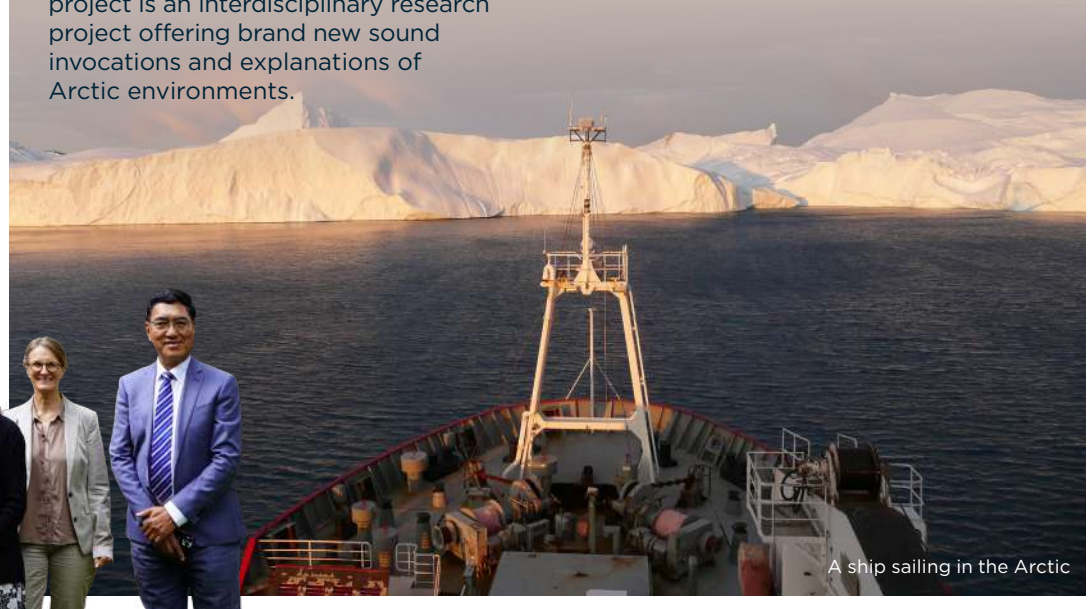
We work collaboratively across disciplines with our global networks and consortia to contribute positively to societal changes and develop innovative world-changing research.

Our membership of the prestigious RENKEI, a consortium of 12 leading UK and Japanese universities, supports our researchers in forging new connections to address pressing global issues such as climate change. RENKEI provides us with a platform to feed into the UK-Japan strategic partnership in science and innovation, including the launch of the UK's new International Science Partnership Funds.

International partnerships are at the heart of our groundbreaking Arctic research here at Durham. As the England Charter member of the University of the Arctic (UArctic) we have made a concerted investment in our Arctic profile, developing inter-university Arctic research and training initiatives. As an example, the Durham Arctic-Soundscapes project is an interdisciplinary research project offering brand new sound invocations and explanations of Arctic environments.

We continue to work closely with the African Research Universities Alliance (ARUA), which facilitates knowledge sharing between individuals in the UK and Africa. We have nurtured the development of a collaborative relationship between the N8 Partnership, an alliance of the eight most research-intensive universities in the North of England, and ARUA. We are currently establishing a joint seminar series which brings together researchers — forming and strengthening networks in anticipation of future funding opportunities.

Our long-held partnership with the Palace Museum in Beijing signifies our joint commitment to promoting research, conservation, exhibitions, cultural heritage protection; and advancing studies of archaeology and ancient culture. The agreement, which is the first between the Palace Museum and an English university, builds on our already strong links with China. One of the highlights of the collaboration has been a joint excavation conducted within the Forbidden City, which brought together archaeologists from Durham and the Palace Museum.



A ship sailing in the Arctic

Fostering interdisciplinarity– collaboration, exploration, innovation

Our research is built on collaboration and partnership – recognising that we can achieve more together.

A collaboration between researchers during a workshop

Fast facts

We are home to 10 research institutes, and support over 80 research centres across our four faculties.

Our interdisciplinary approach gives us new perspectives and sparks novel approaches.

Fundamentals of life

Across the physical sciences, our research is investigating the foundations of life.

Our leading Institutes for Computational Cosmology, Particle Physics and Biophysical Sciences bring collaborative thinking to age-old questions, exploring the origins of the Universe, the fundamental building blocks of our world and the essential systems of life.

Health and wellness

We are also bringing new understanding and insight into areas of health and wellness.

Our Institute for Medical Humanities investigates marginalised or invisible aspects of health and illness to transform understanding and improve wellbeing.

The Wolfson Research Institute for Health and Wellbeing inspires and supports research into human health questions. From infectious disease and infant sleep, to social justice, violence and abuse, its work has individual and global reach.

Global challenges

Durham Energy Institute is helping to find solutions to the urgent need for global energy decarbonisation.

Meanwhile, our Institute for Hazard, Risk and Resilience is empowering people living with hazard and risk, fostering resilience and improving lives.

And our Institute for Data Science provides a hub for leading interdisciplinary research into AI, machine learning and data analytics.

Culture and ideas

We are inspired by the UNESCO World Heritage Site of Durham Castle and Cathedral that we call home.

Our Institute of Medieval and Early Modern Studies investigates everything from the history of the book, to food through the ages. Meanwhile, our Institute of Advanced Study is dedicated to big ideas, bringing together different views and subjects to inspire creativity and new insights.

> **Read more:** https://bit.ly/4aPSqAx

Bringing lived experience to the fore in interdisciplinary health research

Our Institute for Medical Humanities (IMH) was recently awarded a £9.5m grant from Wellcome to develop a new Discovery Research Platform for Medical Humanities (DRP-MH).

Silhouette of two friends raising hands in celebration

Fast facts

£9.5m

— the largest grant made by Wellcome for humanities research.

One of the largest grants made by Wellcome for humanities research, it makes our DRP-MH a beacon for the transformative power and value medical humanities research brings to understanding health and human experience.

Putting lived experience first
Through the platform we are bringing the stories of people living with complex health conditions to the forefront of health research.

It also includes 'lived experience researchers' – people with lived experience and from marginalised communities who co-create research to better address global health difficulties, including mental ill health and health inequalities.

Led by Professor Angela Woods, Director of our Institute for Medical Humanities, and Dr Ben Alderson-Day, from our Department of Psychology, the Discovery Research Platform supports a diverse, international, and interdisciplinary network of researchers to develop new and experimental approaches to difficult health problems.

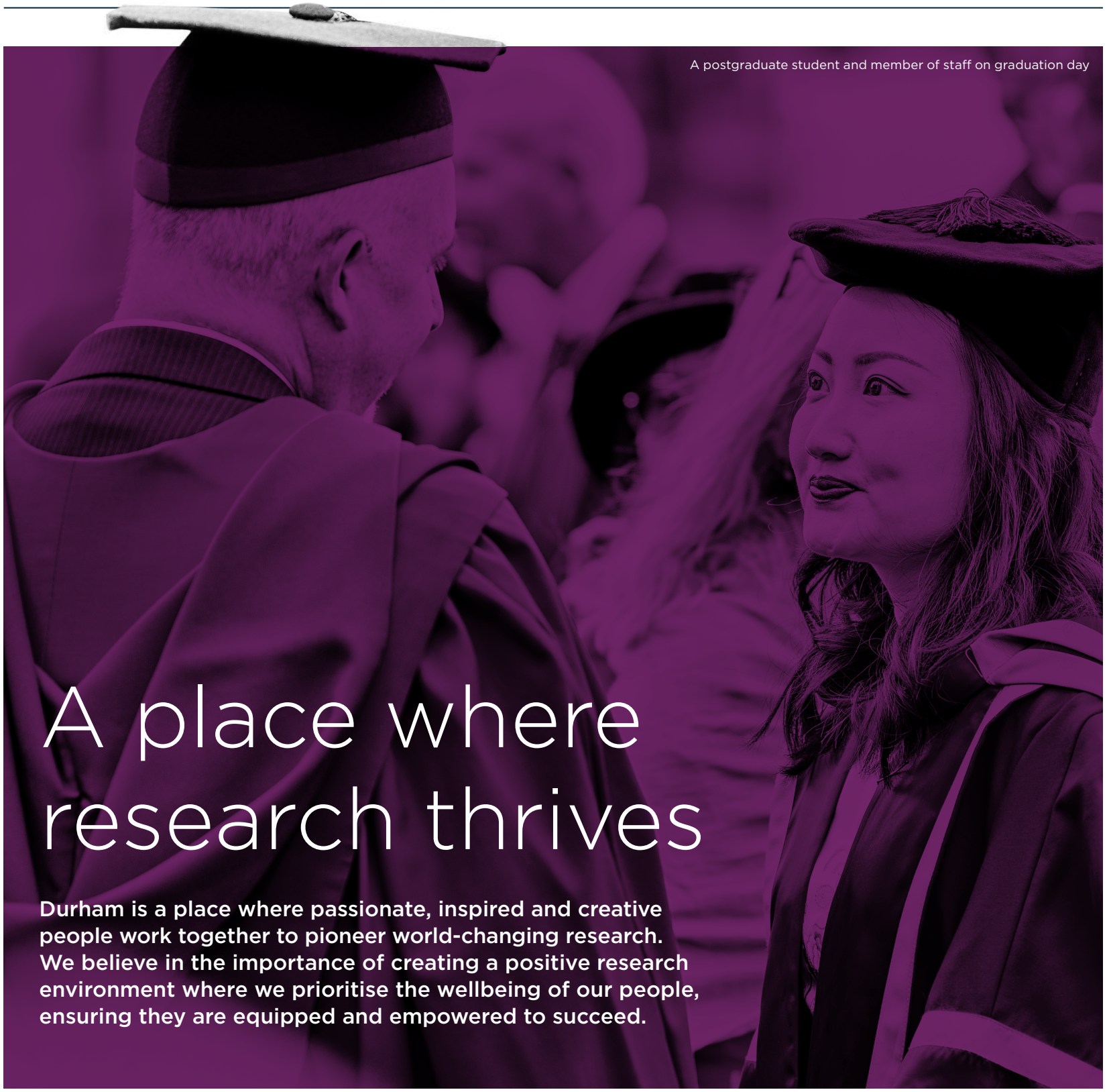
Ultimately, the platform will involve over 200,000 academics worldwide, through international partnerships with leading universities in China, Sweden, South Africa, the Netherlands and USA, with an overall goal of transforming healthcare research and policy.

Building on Durham's research excellence
The DRP-MH builds on the research excellence and flourishing research culture of our Institute for Medical Humanities.

It will support the UK's first Creative Facilitation Unit – a group of specialist staff skilled in the use of arts-based and experimental techniques that enhance interdisciplinary and cross-sector collaboration – to foster new research.

> **Watch more:**
£9.5m Wellcome grant for the Discovery Research Platform for Medical Humanities

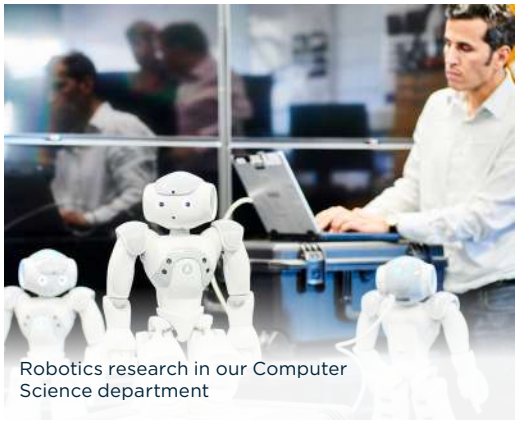
> **Read more:**
https://bit.ly/3RNqwN7



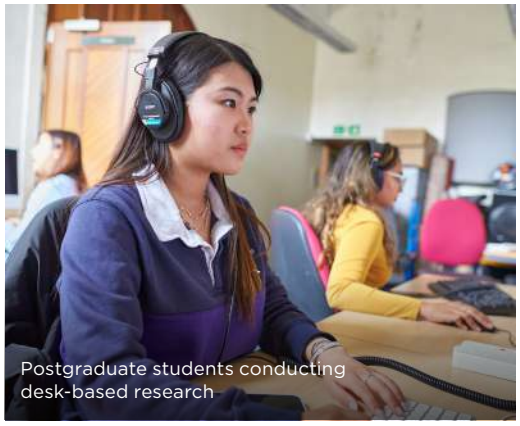
A postgraduate student and member of staff on graduation day

A place where research thrives

Durham is a place where passionate, inspired and creative people work together to pioneer world-changing research. We believe in the importance of creating a positive research environment where we prioritise the wellbeing of our people, ensuring they are equipped and empowered to succeed.



Robotics research in our Computer Science department



Postgraduate students conducting desk-based research

Our Flourish@Durham programme seeks to enhance our research culture to make research fun, fulfilling and fruitful for our communities. The programme aims to ensure the best environment possible for everyone involved in research to develop and thrive through a research strategy that is ambitious and sustainable.

Our core themes through the Flourish@Durham project are:

- Creating the best environment for all to flourish;
- Being ambitious in our research and positive in our culture;
- Respect for everyone's role and investing in our community; and
- Enabling structures that encourage collaboration and openness.

Central to our vision is nurturing our next generation of researchers. Flourish@Durham is supporting the Durham University Research Staff Association (RSA) to highlight the role it plays in developing a supportive and positive research culture for our early career researchers. The RSA is open to all our academic researchers and acts as a crucial voice in University policy-making decisions, as well as a vibrant social forum, ensuring that our researchers feel heard, supported, and connected.

We work across different communities in the University, including professional services, technical staff, and researchers at all levels to enable the most productive research to happen in an open and collaborative environment.

Together, we aim to champion inclusivity, collaboration and innovation to foster an environment that encourages all to flourish.

> **Find out more:**
https://bit.ly/3HhloM4

Northern Accelerator – a catalyst for commercial success

Northern Accelerator is an innovative partnership between the universities of Durham, Newcastle, Northumbria, Sunderland, Teesside and York. With funding from Research England and the UK Shared Prosperity Fund, it has developed a robust programme of support to help academics translate their research findings into commercial products and services that make a social and economic impact.

The trailblazing programme supports a range of activities to ensure spin-out businesses have the best chance of success.

> **Find out more:**
https://bit.ly/3SbGiS7

Northern Accelerator

Fast facts

47 spin-out businesses

have been created in a range of sectors – from cancer-curing drugs to carbon-negative building materials (as of December 2023).

Revolutionising approaches to infant sleep safety

Research into infant sleep safety by our anthropologists has helped reduce rates of Sudden Infant Death Syndrome (SIDS) and provided evidence-based advice that has made an impact globally.

Parents and babies co-sleeping
Image courtesy of Rob Mank

The research has been used to advise health professionals and parents all over the world and underpinned a rethink of official infant sleep safety guidance in the UK.

Led by Professor Helen Ball, Director of the Durham Infancy and Sleep Centre, our research has substantially influenced the policy around national guidelines on infant sleep safety by demonstrating the close link between bed-sharing and breastfeeding.

The research led to the launch of the Baby Sleep Information Source (BASIS) to provide easily accessible infant sleep guidance to parents. This portal is shared and recommended widely by parents and health professionals as a reliable evidence-based source of information on normal infant sleep.

Fast facts

With partner organisations, the research has helped to cut the risk of Sudden Infant Death Syndrome in half*.

*Based on data from UK Office for National Statistics.

Our researchers have been studying infant sleep for 20 years. During this time, they have made several noteworthy discoveries emphasising the importance of parents' need for information about safely bed-sharing with babies. They also highlight how infant care messages are received and perceived by minority groups and how infant care practices vary between cultures.

In 2017 this outstanding work earned The Queen's Anniversary Prize for Higher and Further Education for "leading influential research on parent-infant sleep with a widely-used public information service".

> **Read more:**
https://bit.ly/3tHZRt5

> **Watch more here:**
Pioneering research in infant sleep safety

Mountains in Nepal
Photo credit: Dipak Basnet

Preparedness and planning for the mountain hazard chain in Nepal

Earthquakes and associated hazards such as landslides are a major recurring threat across many countries. Work by our Geographers informed the humanitarian response to the devastating 2015 Gorkha earthquake in Nepal, as well as preparedness efforts for future events.

Led by Professors Nick Rosser and Alex Densmore from our Department of Geography, the research has highlighted two important advances to improve resilience to large earthquakes: understanding where earthquake-triggered and post-earthquake landslides have occurred and what risks they pose, and developing innovative scenarios for future earthquake impacts to help the humanitarian community to prepare for the next event.

The resulting ensemble of earthquake scenarios has been used by the United Nations, the Government of Nepal, and international non-governmental organisations (NGOs) to underpin the national-level earthquake Emergency Response Preparedness Plan. The plan guides the response of the Humanitarian Country Team in Nepal to the next major earthquake. Research is continuing with the Sajag-Nepal project, which uses multinational partnerships to improve preparedness for the mountain hazard chain in Nepal.

> **Read more:**
https://bit.ly/47q6TjP

Collaborating to preserve Asian heritage

International heritage sites are at serious risk from development, climate change, environmental hazards, and conflict.

Led by UNESCO Chair and Professor of Archaeology Robin Coningham, our field programmes in South Asia combine archaeological investigations, heritage science and community mapping to record local heritage and traditions. Our innovative ‘risk maps’ have helped reverse damaging proposals and enabled interventions supporting sustainable pilgrimage protection, benefitting local communities.

While researching the contributing causes of the collapse of historic monuments, we identified indigenous seismic adaptations which have informed the renovation and reconstruction of damaged monuments in Kathmandu.

Prioritising in-field training, we have encouraged the mobility of heritage practitioners in Asia to gain new insights and share expertise. This has led to the adoption of risk maps in Nepal, Myanmar, and India, as well as the post-disaster methodologies co-designed in Kathmandu applied to conflict-damaged heritage in northern Sri Lanka.

Many of our methodologies have since been incorporated into our International Cultural Heritage Management Masters programme, providing students with practical applications of research-led learning.

> **Read more:**
https://bit.ly/3SlCMWH

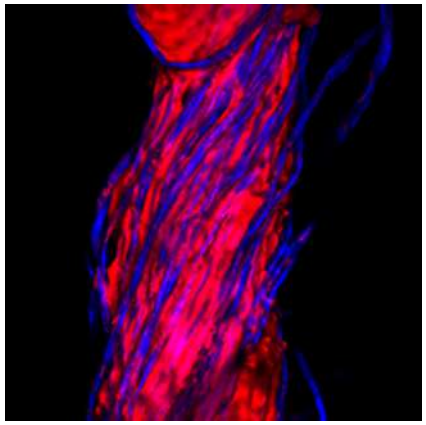
Fast facts

We have helped strengthen post-disaster guidelines in Nepal after the 2015 earthquake.

Sustainability meets science: inside the world-leading research powering Procter and Gamble's cleaning products

Our award-winning partnership with Procter and Gamble (P&G) has enabled unique and globally scalable innovations to improve billions of consumers' lives around the world.

A mother and child doing laundry



3D optical microscopy image

Putting laundry formulations under the microscope

Washing clothes at environmentally friendly low temperatures saves on running costs and stops clothes from shrinking and fading. P&G's laundry detergent needs to be able to remove soil and stains at lower temperatures, without compromising on performance.

The process is difficult to study in detail as grease is optically active – causing images to be blurred or distorted – making it difficult to judge the effectiveness of different detergent formulations.

Using 3D optical microscopy, combining widefield and beam scanning imaging, our researchers were able to develop 'the world's smallest washing machine' under a microscope.

Our researchers also used imaging techniques to test different formulations at low wash temperatures. New experimental techniques were developed to understand the effectiveness of laundry additives and this work contributed to the introduction of new patented polymer technologies into single unit dose formulations – such as Ariel washing pods.

Using surface science to make your dishes shine

The need for dishwashers to be more efficient at lower washing temperatures drives P&G's continuous testing and product innovation in formulations and additives.

Our research has helped P&G better understand the dishwashing process and has led to significant down-scaling of their test methods as well as reducing testing time for new materials.

Our interdisciplinary research into more environmentally friendly, phosphate-free combination additives has reduced formulation testing times contributing to significant efficiencies in accelerating the innovation potential to advance next-generation formulas.

> **Read more**
https://bit.ly/3NQQ4HJ
https://bit.ly/3SacV3D

A device that measures optical turbulence

Advancing free-space optical communication networks

Our researchers are working with Viasat, a global communications company, to understand atmospheric turbulence in free-space optical (FSO) communications.

They have designed a unique device for optical turbulence measurement that can work continuously, day and night, even in the presence of strong turbulence conditions. This state-of-the-art forecasting tool will optimise Viasat's ground station design, as well as supporting operational decision-making such as network switching between ground stations based on atmospheric conditions.

Working together with Viasat, our partnership will have a significant impact on the satellite communications industry.

"We're excited to collaborate with Durham University and their leading work on free space optics. We are committed to investing in key research and development for satellite technology, and Durham University was a clear choice, given their leading-edge work on free space optics. The results of their innovative research will be influential in the satellite communications industry, as we collaborate and bring their work from the lab to the marketplace."

Dr Anton Monk
Chief Technology Officer for Wireless Initiatives, Viasat

> **Read more:**
https://bit.ly/41SU4gN

Our Vice-Chancellor signing a Memorandum of Understanding with Atom bank

Building Atom bank's digital twin

We have a long-standing partnership with Atom bank, the UK's first app-based bank. Together we have collaborated on research to explore and drive innovation, including two Knowledge Transfer Partnerships.

This has resulted in the creation of the Atom bank Digital Twin, an end-to-end banking model based on mathematical and statistical methods that is being used to support business decisions in financial planning, resourcing, product pricing and funding.

> **Watch** to find out more

Find out more

durham.ac.uk/global-impact-research

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