



**Northumbria
University**
NEWCASTLE

PEAKS OF RESEARCH EXCELLENCE

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This booklet contains QR codes and short links which take you to the Peaks of Research Excellence webpages for further information.

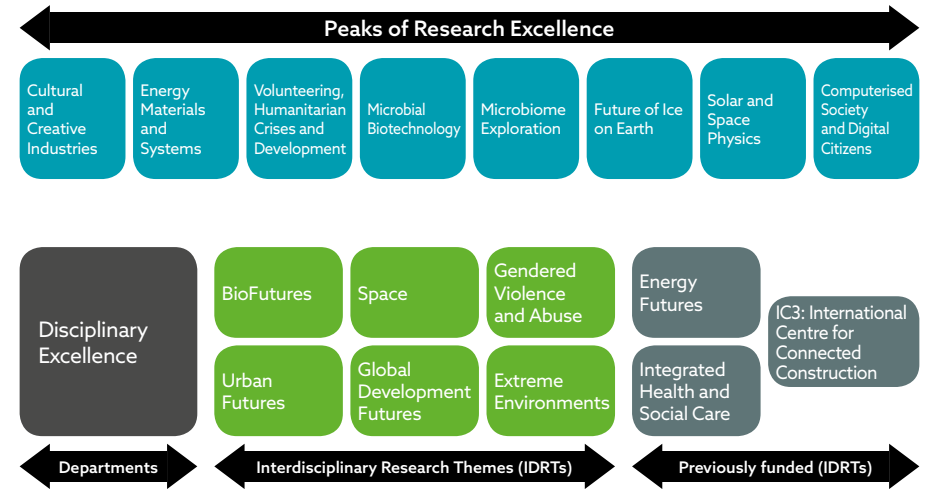
FOREWORD



Northumbria is a research-intensive university with a proud heritage of making a difference to individuals and to society. We work in partnership in the North East and London, the UK and globally. We change lives through education and research, tackling the global challenges of our age to transform society.

We're world class at many things, but particularly recognised for our expertise in some areas which we call our Peaks of Research Excellence. Our Peaks of Research Excellence are a vital part of our vibrant research landscape alongside the high quality research undertaken in our academic departments and in our Interdisciplinary research Themes (IDRTs). This booklet presents an overview of our Peaks of Research Excellence and how they respond to the needs of the communities we work with locally, nationally and internationally.

Our Research Landscape



Our Peaks of Research Excellence are focused and cohesive areas of outstanding research, led by smaller groups who are leading research worldwide. Some have developed from IDRTs, others have grown from departmental research. The Peaks are areas that organically emerge from the high quality research that we do, we may support these strategically but mostly they are funded by external income.

Hopefully, this gives further insight into the way we are thinking about our research landscape.

Professor Louise Bracken

Pro Vice-Chancellor (Research and Knowledge Exchange)
Northumbria University



View our Peaks of Excellence



View our Interdisciplinary Research Themes

THE RESEARCH LANDSCAPE AT NORTHUMBRIA UNIVERSITY

Northumbria University's research landscape comprises three key elements. All of these elements are important and enable us to celebrate, support and communicate the research we undertake in a range of ways, but also support the development of new areas of expertise.

- **Disciplinary Research Excellence**, undertaken in all our Departments and evidenced by our Units of Assessment as part of the Research Excellence Framework exercise.
- **Peaks of Research Excellence**, cohesive and more narrowly focused groups of researchers that deliver high quality outputs and impact, often securing substantial income. These are self-sustaining, undirected and develop organically, sometimes from IDRTs. The research is mostly externally funded, but the areas identified are supported by Departments or other routes.
- **Interdisciplinary Research Themes (IDRTs)**, communities of research practice which work across Departments and disciplines, enabling rich, collaborative discussions about research from a range of diverse perspectives to generate high quality research.

COMPUTERISED SOCIETY & DIGITAL CITIZENS

This Peak of Research Excellence is focussed on delivering outstanding, internationally leading research that generates new understandings of how society and citizens are affected and transformed by our dependence on computing.

The Peak draws on Northumbria University's extensive track record for research in digital citizens and the digital economy, in interaction design and social computing, as well as user-centred approaches to trust, privacy and security and, not least, our developing strength in citizen centred approaches to AI.

Our academics are delivering research to understand societal questions and concerns around how citizens can be digitally empowered to engage with governments, political organisations, healthcare providers and civic authorities on a local and national scale.

Our Research Tackles:

- Diverse issues affecting engagement with democratic process
- Health and social care delivery
- The accelerated impact of AI on everyday lives
- Citizen susceptibility to online harms and misinformation
- Methods of improving individual and community cyber-resilience
- Novel means to provide citizens an equal voice in a digital world

This, necessarily interdisciplinary, research regularly attracts significant UKRI and EU funding and is routinely conducted in partnership with a huge range of UK and international partners from academia, the public sector, media, business and industry. The Peak was recently awarded £9.2million to fund one of the twelve AI-focussed UKRI Centres for Doctoral Training (CDTs) in Citizen-Centred AI.

Find out more

northumbria.ac.uk/CSDC

Our Academic Profiles

northumbria.ac.uk/CSDC/profiles



CULTURAL & CREATIVE INDUSTRIES

Northumbria's research in the Cultural and Creative Industries (CCI) focuses on the cultural, civic, and economic value of these industries regionally, nationally, and internationally. Researchers in CCI have extensive expertise in film, media, the arts, museums and heritage, music, fashion, design, creative writing, cultural policy, and theatre and performance. Our research leverages interdisciplinary, collaborative approaches and practice-based enquiry to tackle challenges in some of the following ways.

Our CCI Community

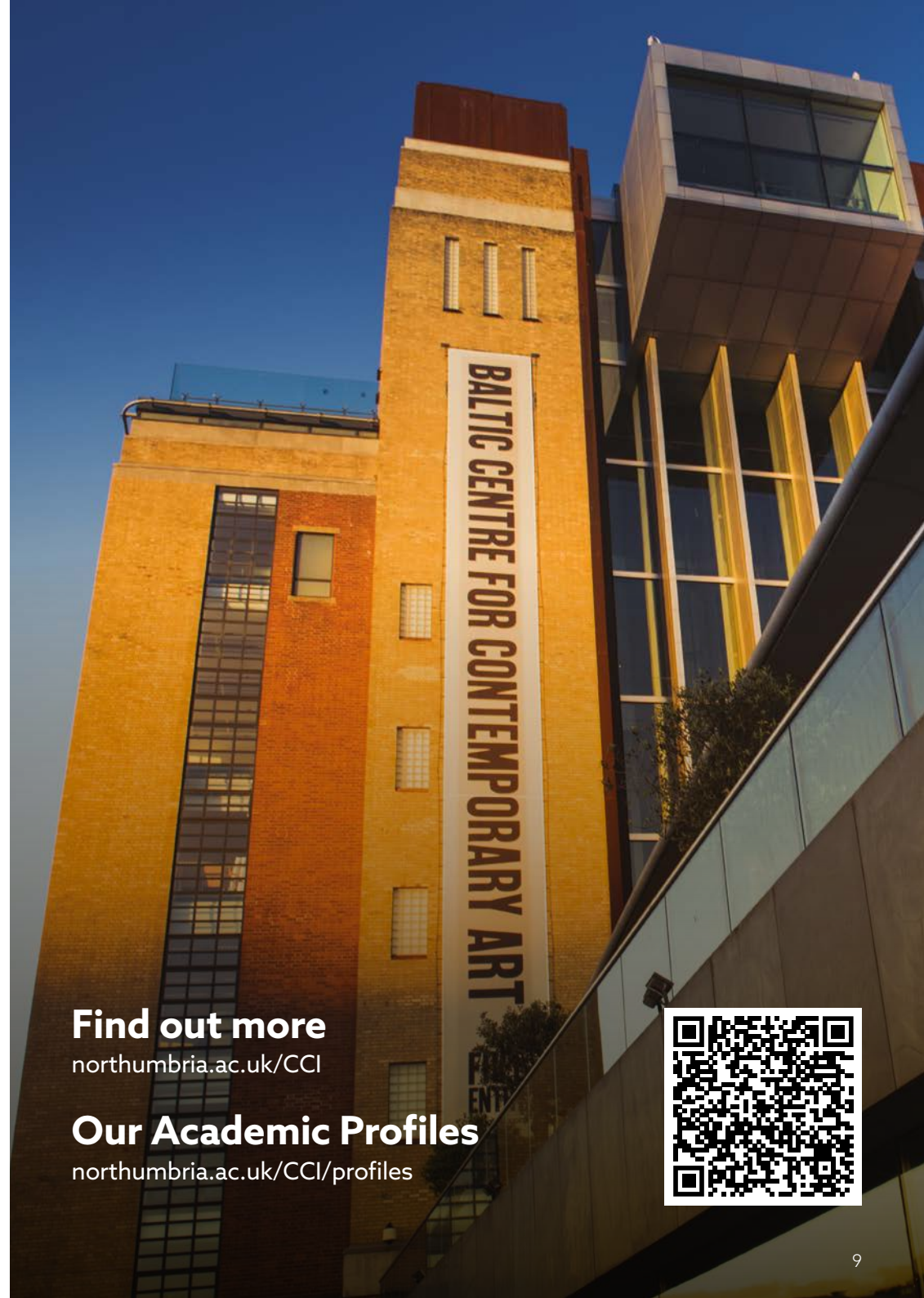
Our researchers push the boundaries of excellence in practice-led research, winning honours from the BBC, and nominations for national awards like the Turner Prize. CCI leads Northumbria's established cultural partnerships with the Baltic, New Writing North, TWAM, Live Theatre and BFI, bringing industry and diverse communities together to shape the future of creative ecologies and economies.

Real World Research

CCI research projects led to major shifts in strategic thinking among leading UK publishing houses, creating three literary development businesses. Our £1.3million UK Research and Innovation (UKRI) Creative Communities programme investigates novel means to measure and assess 'value' within the cultural sector post-COVID. Performance studies research advanced policy changes, ensuring the inclusion of cultural leadership in long-term strategic emergency planning in New Orleans, USA. Design researchers, funded by the Arts and Humanities Research Council (AHRC), developed culturally specific design approaches, helping to establish the Design and Social Innovation in Asia-Pacific (DESIAP) network, supporting 600 social innovation practitioners from 14 countries to improve social outcomes for marginalised communities.

Future Facing

Research on the history of horror and exploitation film (UKRI funded), led to transformational findings for the future of horror film production internationally. AHRC funded research from performance scholars will provide the first major study of how the UK and Scottish government's Gender Recognition Act consultations (2017-20) impacted the commissioning, production, and reception of trans-led cultural practices.



Find out more

northumbria.ac.uk/CCI

Our Academic Profiles

northumbria.ac.uk/CCI/profiles



ENERGY MATERIALS & SYSTEMS



Renewable Energy
Northeast Universities

The World faces an unprecedented challenge in getting to net zero carbon emissions by 2050. Our energy materials and systems research draws on fundamental physics, chemistry, biology and engineering to develop new ways to generate and store renewable energy in order to help deliver a cleaner and greener future.

Northumbria specialises in new materials for energy and energy systems. This includes converting sunlight to electricity using new implementations of photovoltaics, and the conversion of carbon dioxide from greenhouse gas to sustainable products. We also focus on the integration of energy technologies such as batteries and electric vehicles in the whole energy system, to deliver tangible carbon dioxide savings.

As well as helping the net zero mission, we aim to help create highly-skilled jobs, both in the North East and nationally, via the innovations that happen in our labs. Collaboration is key to our success, and we work with a range of partners, from industry heavyweights like Shell, Siemens, Airbus and Arup to other universities, governments and many small to medium enterprises.

Together with Newcastle and Durham Universities, Northumbria University also leads a doctoral training programme in renewable energy, ReNU. This £5.5million programme is jointly accredited by the Institute of Physics and the Royal Society of Chemistry and will train the next generation of innovators in clean energy. The majority of our research grant awards are from UKRI via the Engineering and Physical Sciences Research Council (EPSRC) but we have also received funding from the British Council, the European Union and directly from Industry.

Find out more

northumbria.ac.uk/EMS
renu.northumbria.ac.uk

Our Academic Profiles

northumbria.ac.uk/EMS/profiles



MICROBIAL BIOTECHNOLOGY

Our academics working in microbial biotechnology explore and exploit microbial systems to develop transformative solutions for a more economically and environmentally sustainable society.

This Peak of Research Excellence is dedicated to developing novel technologies which will significantly contribute to global sustainability by using microbial biotechnology to reduce carbon emissions and recycle waste products. We work in close collaboration with a range of industrial partners including Procter and Gamble, Prozomix, the Royal Air Force and Johnson Matthey, as well as other Universities and organisations.

Northumbria's research in microbial biotechnology brings together academia and businesses to tackle global challenges. Our researchers are working at the frontier of development in biotechnologies for: renewable energy, sustainable materials, bioremediation, and carbon removal and capture. Contributing to the circular economy and UN Sustainable Development Goals.

We have received over £11.6million in funding in the Microbial Biotechnology area. Funding which includes a £8.5million (E3 funded) collaboration bringing together bio-scientists from Northumbria University and architects, designers and engineers from Newcastle University to create the 'Hub for Biotechnology in the Built Environment' (HBBE). Since forming, the HBBE created another strong springboard for Northumbria's Biotechnology research, and has resulted in numerous new grant awards, a diverse array of publications and a vibrant community of interdisciplinary researchers together working in state-of-the-art Northumbria laboratories.

Find out more

northumbria.ac.uk/microbial

Our Academic Profiles

northumbria.ac.uk/microbial/profiles



MICROBIOME EXPLORATION

The information carried on DNA as genes, expressed and translated into specific protein functions, in microbes to human, in health and disease, all illustrates the complexity of our biological landscape and our understanding of life.

Multi-omics is a field that uses multiple technologies to offer a snapshot in time of any biological system, offering 'big data' that allows us to begin to understand this complexity; DNA sequence (genomics), gene expression (transcriptomics), proteins and their function (proteomics) and the ensuing metabolism (metabolomics) in our microbial environments. We overlay this data to offer the highest resolution essential to understand our built environment, health, our microbial world, and those microbes related to disease.

At Northumbria, based around a both regionally and nationally important genomics facility NU-OMICS, we work on a range of funded microbiome sciences projects, understanding its complexity and function. We formed an integral part of the UK's pandemic response as part of COG-UK and as a UKHSA DNA sequencing resilience site. Over this 2-year period we sequenced over 100,000 SARS-COV-2 genomes. We also developed supporting informatics tools to aid sequencing proficiency, and virulence prediction of new SARS-CoV-2 variants (SPEAR). We have key projects looking at microbial carriage in breastmilk and its role in GI development in preterm infants; the roles of lung and gut microbiota in chronic diseases, including cystic fibrosis and non-cystic fibrosis bronchiectasis; and mapping the microbiome of our polar regions. As part of the Research England funded 'Hub for Biotechnology in the Built Environment' (HBBE) we have established standardised approaches for microbial sampling of the built environment (surfaces and biomaterials), focussing on new dwellings during build to occupancy, alongside markers of rurality and supportive tools to annotate environmental aspects of microbiomes and other omics samples on a global scale (OMEinfo).

NU-OMICS has supported collaborative research projects with several large companies that utilise microbiome data. These companies include but are not limited to: Proctor & Gamble, Reckitt Benckiser, GSK, Pepsico, and Pukka Herbs.

Find out more

northumbria.ac.uk/microbiome

Our Academic Profiles

northumbria.ac.uk/microbiome/profiles



SOLAR & SPACE PHYSICS

Northumbria is home to the North East Space Skills and Technology Centre (NESST). This £50million state-of-the-art building is a UK-wide space asset and trains the next generation of space-related engineers. Our Solar and Space Physics researchers work to understand the physics of the Sun, the solar-terrestrial connection, and all aspects of space physics. To better protect and utilise humanity's use of space, we have a particular focus around space weather and satellite technology.

Space Weather

The Sun is the powerhouse of our solar system and its daily variability can have profound consequences for Earth. Space weather is the name given to the impact of events - like solar flares or coronal mass ejections - on our technologically-advanced society.

This impact can be both beautiful, like the Northern lights, or extremely detrimental such as damaging satellites or increasing radiation that is harmful to aircrew and astronauts. Adverse space weather can also have a significant economic impact, for example communications blackouts, disruption to aviation, and satellite damage.

Space weather is featured on the UK National Risk Register of Civil Emergencies. Our research is improving space weather forecasts and we work in partnership with the dedicated Met Office Space Weather Operations Centre.

Image of the Sun's outer atmosphere, the corona, adapted from Morton, Weberg & McLaughlin, 2019, Nature Astronomy, 3, 223

Satellite Communications

Space-related-instrument development drives forward the national capability of UK-based satellite communications and advances the camera-technology sector. This hardware and instrument development is of great benefit to the future of small-satellite missions. We already work with multiple space-related-hardware industrial partners via our UK Space Agency funded projects, e.g., Lockheed Martin and the Ministry of Defence for laser communications, e2E for space electronics, and EnduroSat for CubeSats. We have received over £15million in funding from the UK Space Agency and UK Research & Innovation (UKRI).

Our Space Research community

Our Solar and Space researchers demonstrate international leadership across advanced numerical modelling, mathematical theory, observations of solar and space plasma, data intensive science, and space-related hardware.

We collaborate extensively with partners including UKRI, the UK Space Agency, the European Space Agency, the UK Met Office, and over 40 industrial partners.

Find out more

northumbria.ac.uk/solar-and-space

Our Academic Profiles

northumbria.ac.uk/solar-and-space/profiles



THE FUTURE OF ICE ON EARTH

Future of Ice on Earth focuses on research into ice sheets and glaciers on a global scale, observing, modelling, and predicting future ice loss from all glaciated areas in a warming world. Our researchers are working to understand the causes of ongoing changes in Antarctica, Greenland and alpine areas, as well as assessing future changes and resulting impacts on human environments worldwide.

Addressing these global scale challenges involves advancing our understanding of external and internal processes connected to the dynamics of glacier flow and interactions with the ocean and atmosphere. We develop ice-flow and ice-ocean models, which underpin research activities at several UK Universities and worldwide and use these to simulate the future of the Antarctic and Greenland Ice Sheets and their interactions with the climate system.

We aim to provide much improved assessments of the Future of Ice on Earth and assist policy makers in planning and developing mitigation measures. This research will ultimately help us plan for, adapt to and reduce the sea level impacts of climate change globally. The total grant income generated by the Peak since 2018 is £10.2million. The year 2023 was our most successful year in this respect with five separate grants awarded to the sum of £3.15million.

Recent Successes Include:

Prediction of Climate Change and Effect of Mitigating Solutions (PRECISE): A collaboration between Northumbria University and Niels Bohr Institute in Denmark and Danish Meteorological Institute, funded by the private company Novo Nordisk. The aim is to provide new assessments of the future of the Greenland and Antarctic Ice Sheets.

Find out more

northumbria.ac.uk/future-of-ice

Our Academic Profiles

northumbria.ac.uk/future-of-ice/profiles

Travels across Rutford Ice Stream, Antarctica, with Ellsworth Mountains in the background. Source: G. Hilmar Gudmundsson

Coupled Evolution of Ice Shelf and Ocean in the Amundsen Sea Sector of Antarctica: We will use an autonomous submarine to make oceanographic measurements around Antarctica with the aim to constrain models of ice and ocean interactions.

Greenland Ice Sheet and Sea-Level Response Under Climate Change from AD 1600 to 2100: In collaboration with Lincoln and Durham Universities we will model past and future changes of the Greenland ice sheet and conduct measurements to validate our models.

Re-thinking Antarctic Sea-Level Projections (RASP): We will develop new and novel approaches to close a knowledge gap related to links between far-field ocean conditions and ocean cavities around Antarctica.

Interacting Ice Sheet and Ocean Tipping - Indicators, Processes, Impacts and Challenges (ISOTIPIC): As a part of this NERC highlight topic, we will investigate tipping points of the Greenland and the Antarctic Ice Sheets. The project involves several partners including the British Antarctic Survey, the National Oceanography Centre, and the Universities of Reading, Southampton, and Liverpool.



VOLUNTEERING, HUMANITARIAN CRISES & DEVELOPMENT

Volunteers play critical roles globally in meeting the challenges of poverty, inequality and the climate emergency, and are often the first responders to humanitarian crises and disasters. They can often offer solidarity, advocate and organise for change, but not all volunteers are treated equally, and some face risks that others are protected from.

International volunteers often receive the most attention when it comes to volunteering in humanitarian and development contexts. But they are far outnumbered by local and national volunteers, who are often first on the scene in a crisis, as well as being critical to longer term development activities. Understanding the roles diverse volunteers play in meeting critical global challenges can help ensure that volunteers are not exploited, that their local and expert knowledge is recognised, and that the potential of volunteering for making a difference is realised in different contexts and for all volunteers.



Community volunteers in Burundi. Source: Bianca Fadel

Northumbria academics are creating a world-leading hub of research expertise, knowledge exchange and learning on volunteering in humanitarian crises and development contexts. We work in partnership with leading global volunteering and development organisations, such as the International Federation of Red Cross and Red Crescent Societies, the International Forum for Volunteering in Development (Forum) and VSO, to design and deliver work together that creates new understanding and changes policy and practice. We also work closely with academics across the world, building networks and connections and promoting new voices in volunteering research.

Our work is supported through significant funding from UK research councils, leading global humanitarian agencies and NGOs in the UK and internationally. This year has seen the launch of Volunteering, Climate Adaptation and Disasters (VOCAD), a new area of research on the climate emergency and voluntary labour, a new collaboration with the International NGO Habitat for Humanity and confirmation of Northumbria University as hosts of IVCO 2024, the leading global conference for policy-makers and practitioners working in volunteering and development.

Find out more

northumbria.ac.uk/VHCD

Our Academic Profiles

northumbria.ac.uk/VHCD/profiles





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Find Out More

To discover more or get involved, please contact the Academic Leads via the Peak of Research Excellence webpages:

northumbria.ac.uk/research



northumbria.ac.uk