



University of
Sheffield

**Research that
changes lives.**

**This is the future.
And it will be
Sheffield made.**

Feeding the world with foam

A refugee camp isn't where you'd expect to find researchers trying to solve the problem of feeding a growing global population. But at the University of Sheffield we're nothing short of resourceful.

There are 80,000 people living in Za'atari refugee camp. The majority of the camp residents are Syrian farmers but they are not permitted to plant into the ground. And even if they could, the soil is largely infertile. This has kept the residents reliant on charities for fresh fruit and vegetables.

But what if there was another way for the camp residents to grow food?

After discovering warehouses packed with used, discarded mattresses, our researchers had an idea. Could the mattresses be used as a growing medium for plants? With a bit of creative thinking our researchers set up hydroponics systems using recycled materials and the mattress foam. The foam replaces the need for soil, and the plants are fed using a nutrient solution.

The residents applied their farming expertise to the principles of hydroponics and the plants flourished. They taught the Sheffield team how to optimise plant growth in these systems and how to make it work on a community level.

Now more than 3,500 refugees have been trained. One resident told us he has 200 plants! The work has now extended to other refugee camps, and other areas in Jordan, Libya, Yemen and Turkey.

Back in our Sheffield labs we are using the knowledge learned in Za'atari to tackle the global challenge of food insecurity. We are developing ways to grow food in urban and other challenging environments so we can stock supermarket shelves across the globe, locally and sustainably.



The University of Sheffield

92%

of our research submitted to REF 2021 was judged to be world-leading or internationally excellent

£200M

in new research awards (for 2021)

6

Nobel prize winners

12TH

12th in the UK for our research power and intensity in the Research Professional News REF 2021 ranking

TOP 10

for research grant funding in UK universities

30,129

students

12TH

for research income in 2020-21 according to HESA data

5 TIMES

Sheffield has received the Queen's Anniversary Prize five times in 1998, 2000, 2002, 2007 and 2019

140

nationalities make up our students and staff

A historic University with a forward facing vision

Our University is over 115 years in the making. From the first documented use of penicillin as a therapy in 1930, a drug that has gone on to save more than 82 million lives worldwide to building Europe's largest research-led manufacturing cluster, home to Rolls-Royce, Boeing and McLaren Automotive, our inventive spirit, and top quality research environment is what sets Sheffield apart.



Professor Sue Hartley

"Across our five faculties, and from fundamental to translational research, interdisciplinary collaboration is central to what we do. We think critically and act creatively to transform the world we live in for the better. We're proud of the difference we've made and continue to make. But we'll never stop exploring new ways to do more.

Whether you're a potential collaborator, delivery partner, student or staff member, I welcome you on our journey of discovery."

Professor Sue Hartley
Vice President for Research
at The University of Sheffield



Our flagship research institutes

Our four interdisciplinary flagship institutes bring together our key strengths to tackle some of the most pressing challenges of our time.

The Institute for Sustainable Food

The world is fast approaching the limit of its ability to feed itself. This is one of the most significant threats facing humanity. However, it is also a problem we can solve. The Institute for Sustainable Food is using cutting-edge research to improve the health and sustainability of global food systems.

Climate resilient wheat

It takes more than 1,800 litres of water to produce one kilogram of wheat, a dietary staple for millions across the globe. The climate crisis is making water supplies unreliable so we've engineered wheat that needs less water to grow, feeding the world's increasing population while using fewer natural resources. We've also achieved similar results with beans and rice.

The Energy Institute

The Energy Institute is advancing towards a safe, secure and affordable clean energy future. We work with industry developing solutions across the spectrum of energy technologies. With our pilot-scale testing facilities we are developing real-world, commercially-viable solutions to the climate crisis.

Implementing resource efficiency on a global scale

We've developed software powered by Microsoft Artificial Intelligence that enables businesses and governments to identify how their supply chains can be made more energy efficient and sustainable. China's policy makers have applied the principles of the tool to several key policies to create resource efficient systems.

The Neuroscience Institute

The Neuroscience Institute is combining expertise in medicine, science and engineering to improve the prevention, diagnosis and treatment of neurological, sensory and developmental disorders and better the lives of patients and their families.

Pioneering stem cell therapy for multiple sclerosis

We demonstrated that autologous haematopoietic stem cell transplants (aHSCT) are the best treatment to date for Multiple Sclerosis. The treatment has had a life-changing impact on patients who have the relapsing remitting form of the disease. Many regained their ability to walk, run and even dance as a result. We're now comparing the efficacy and safety of a one-off aHSCT disease modifying therapy vs first line treatments available on the NHS.

The Healthy Lifespan Institute

The Healthy Lifespan Institute is transforming the experience of ageing. We're the UK's first interdisciplinary research institute dedicated to understanding and preventing multimorbidity and frailty – to help everyone live healthier lives for longer.

Preventing age-related disease

We showed for the first time that heart disease can directly cause brain dysfunction early on which could lead to dementia. Until now it has been unclear how some forms of vascular dementia can happen years before atherosclerosis in the brain. The team is investigating treatments that can reverse or reduce the brain dysfunction caused by heart disease.



A critical mass of state-of-the-art sustainability research

Our translational research is transforming manufacturing processes, built environments and how we make and consume energy for a sustainable future.

Advanced Manufacturing Research Centre

The Advanced Manufacturing Research Centre (AMRC) is part of the AMRC Group, a cluster of world-class centres for industry-focused research and development of technologies used in high-value manufacturing sectors. Our 125-plus industrial partners include global giants like Boeing, Rolls-Royce, BAE Systems and Airbus.

Nuclear Advanced Manufacturing Research Centre

The Nuclear AMRC helps UK companies win work across the nuclear sector and in other low-carbon industries. It works with companies of all sizes to develop new capabilities in areas such as machining, joining, modularisation, additive manufacturing and digital engineering. It is part of the High Value Manufacturing Catapult.

Translational Energy Research Centre

Our Translational Energy Research Centre is one of the largest and best-equipped zero-carbon energy, hydrogen, bioenergy, CCUS and sustainable aviation fuels research and development facilities in Europe. The centre offers pilot-scale testing facilities to understand and demonstrate green energy solutions for a secure, affordable and sustainable energy system.

The Urban Institute

Our Urban Institute is an international research centre which examines how cities are responding to the challenges and opportunities of intensified urbanisation, technological innovation and resource constraint. The Institute's research agenda focuses on the socio-technical, political, cultural and ecological dynamics of contemporary urban life.

How we are making a difference

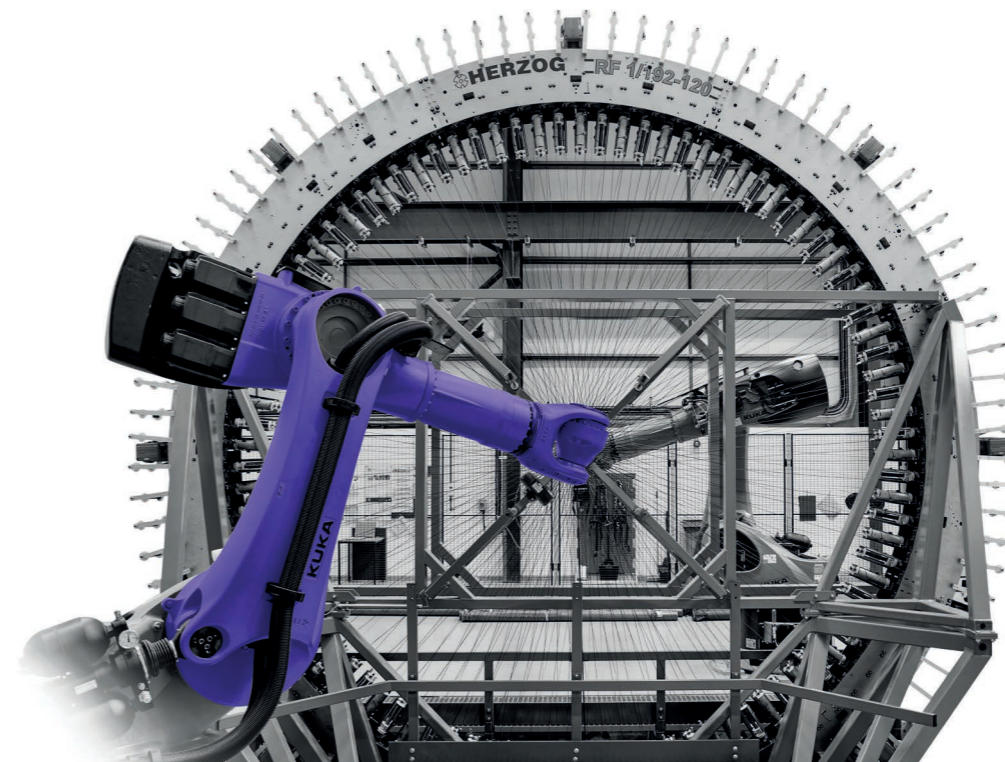
Propelling air travel to a sustainable destination

At the AMRC we developed and scaled-up an automated, efficient aerofoil manufacture process to support Dowty Propellers' flexible manufacturing capabilities of complex blade geometry for its next generation composite propeller blades. The project harnessed composite technologies with industrial digitalisation to cut production costs and increase performance of future propulsion systems. The work formed part of a

project led by Dowty Propellers (part of GE Aviation Systems) to find a new way to manufacture lightweight propeller blades that will help the UK aviation sector reduce its carbon footprint and noise emissions at airports. The technology has huge potential for future manufacturing and is applicable to many industries as well as aerospace including automotive, gas and oil, renewables and construction.

Reducing dependence on fossil fuels

The Translational Energy Research Centre (TERC) is home to a state-of-the-art, low-carbon energy research rig which is the first of its kind in the UK. Designed as a bespoke piece of equipment for the facility, in collaboration with FuelCell Energy, it enables research into an innovative method of carbon capture while simultaneously producing electricity and hydrogen. It will play a key role in a project led by TERC, in collaboration with industrial partners, to produce high quality clean hydrogen that can be used for low carbon heat and power, and deliver long-term, net-negative emissions for a range of industries.



Herzog Radial Braider

A critical mass of state-of-the-art health research

Our medical research is pioneering new treatment and care options to improve the lives of patients and their families.

INSIGNEO

Established in 2012, Insigneo was the first institute dedicated to in silico approaches in medicine. In collaboration with Sheffield Teaching Hospitals NHS Foundation Trust and Sheffield Children's NHS Foundation Trust, we bring together expertise in fundamental biological and physical sciences, imaging, healthcare data computing, computational modelling, and device and sensor development.

The Sheffield Institute for Translational Neuroscience

The Sheffield Institute for Translational Neuroscience (SITraN) is a £20 million international centre of excellence, delivering groundbreaking work in the fight against motor neurone disease and other common neurodegenerative disorders. It was recognised with the Queen's Anniversary Award in 2019 for its positive impact on the lives of patients.

Gene Therapy Innovation and Manufacturing Centre

The GTIMC dramatically broadens the scope of gene therapy research in the UK. The Sheffield centre brings together partners from the north of England, the Midlands and Wales to advance knowledge of gene therapies so that we can translate scientific discoveries into new and exciting treatments for patients.

Sheffield PET-MRI facility

Our PET-MRI is the UK's 8th and Yorkshire's only PET-MRI facility. The scanner will provide unprecedented views of inside the human body by combining the power of both MRI and PET images in a single scan.

Centre for Care

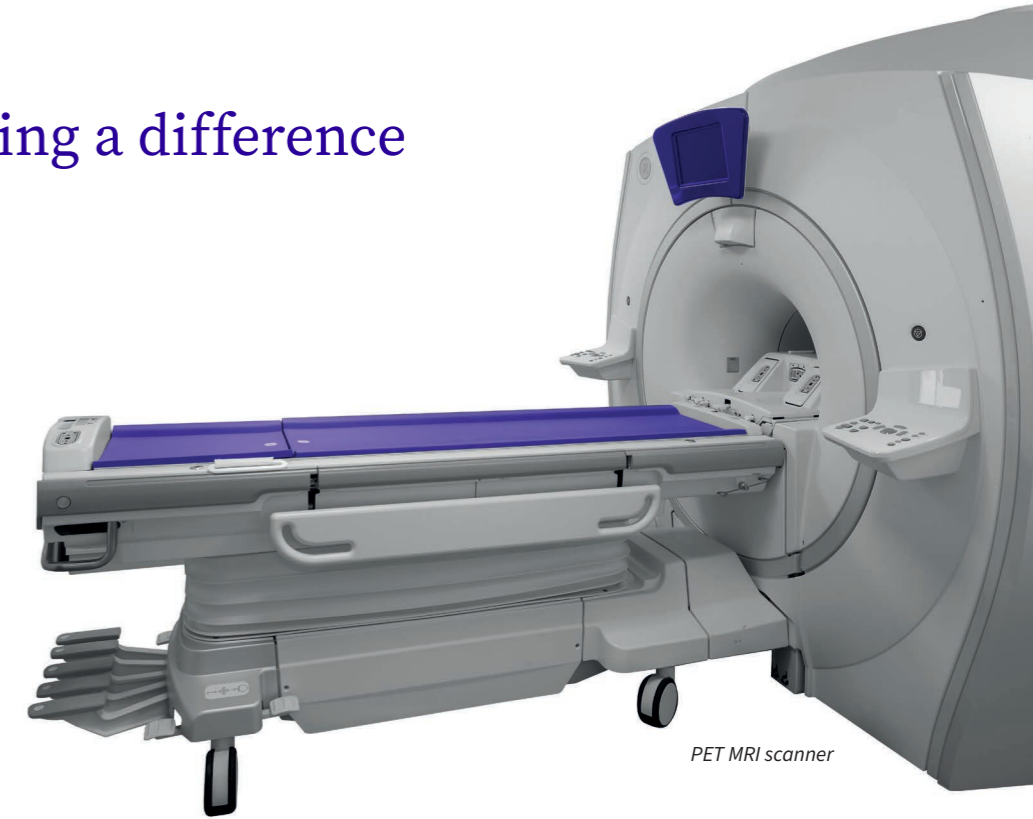
The Centre for Care links experts on care in five universities, three major charities and the UK's Office for National Statistics. Funded as an ESRC Research Centre to address the need for evidence on care that can make a difference, we have built a large research team to co-produce excellent research on care topics that really matter. We work closely with partner organisations in the care sector and people with direct experience of care.

How we are making a difference

Safer and more detailed MRI scans

We have pioneered the technology for a novel type of MRI (magnetic resonance imaging) scan that uses inhaled hyperpolarised xenon gas to show more detailed information about gas exchange in the lungs. More sensitive to lung function than existing scans, this new technique has also been applied to image gas exchange in the brain.

We performed the world's first clinical diagnostic scanning with this technology in partnership with Sheffield Teaching Hospitals NHS Foundation Trust and Sheffield Children's NHS Foundation Trust. We are now leading studies with xenon MRI to improve understanding of post-Covid lung disease, cystic fibrosis, interstitial lung disease and pulmonary vascular disease. We are also making the technology more accessible around the world by supporting the installation of gas polarisers and developing the methods needed to adapt standard clinical scanners to pick up the xenon signals.



PET MRI scanner

Pioneering gene therapies

Spinal muscular atrophy (SMA), a devastating disease which affects children, is caused by an abnormal survival motor neuron (SMN) gene, which leads to a reduction of SMN protein levels. Approximately 50 per cent of affected children die before two years of age.

Researchers from SITraN first demonstrated restoration of the missing SMN protein using gene therapy replacement. This pioneering preclinical work provided the confidence for

pharma companies to invest in human gene therapy trials which led to the FDA approval of Zolgensma®. A single dose of Zolgensma®, encodes the missing SMN protein, resulting in babies with type 1 SMA achieving developmental milestones where they previously would have declined.

Our new Gene Therapy Innovation and Manufacturing Centre will greatly advance our ability to treat rare genetic diseases that collectively affect up to 10 per cent of the world's population.

Research that changes lives

Premature birth affects 15 million babies every year worldwide - that's more than 1 in every 10 births. Globally, it is the leading cause of death for children under the age of 5, with 60 per cent of preterm births occurring in Africa and South Asia.

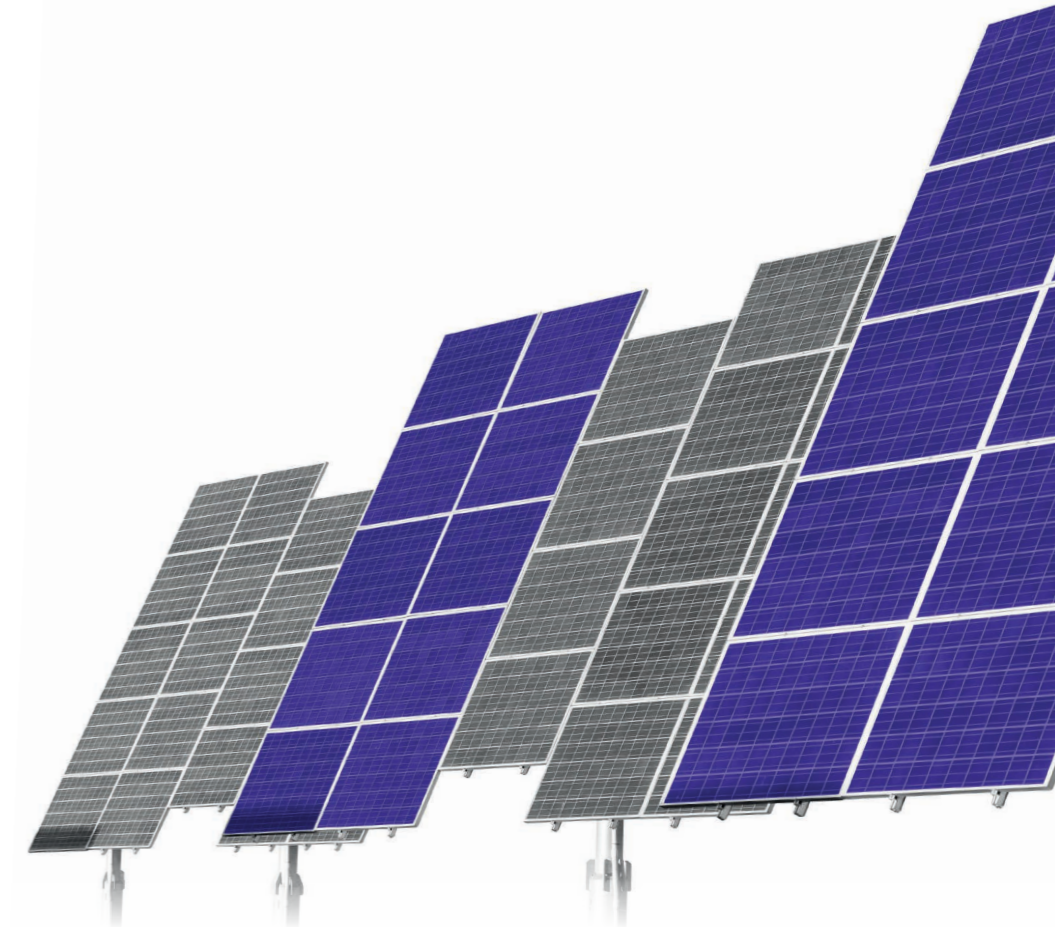
We are implementing ways to reduce child death and disability caused by premature birth. In collaboration with hospitals and universities in South Africa, Bangladesh, India and Nigeria the team is designing guidelines and interventions that can be tested and adapted for use across low-middle income countries and help mothers and babies across the world.



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Solar power is seen as a key way of addressing East Africa's energy challenges, but the solution is not as simple as installing traditional solar panels across large areas of land because the land is also needed for agriculture. Our agrivoltatic systems not only provide sustainable, reliable and affordable energy systems they also improve the productivity of crops.

The agrivoltatic systems are mounted on stilts and provide much needed shade which reduces heat stress on plants and protection from water loss. They also allow for rainwater harvesting. Working with African solar developers and a Kenyan agribusiness company, we are trialling implementation in Kenya and Tanzania.



Research that changes lives

Journalists face serious kinds of human rights abuse simply for trying to keep the public informed. The online space is becoming increasingly hostile with journalists facing gendered attacks, hate speech, organised mass harassment, and systematic surveillance.

To make it safer for journalists we are developing a framework to improve data collection on the full range of violations against journalists and track trends to prevent future attacks. We are also developing methodologies for tracking patterns in the escalations of violence, such as the progression of online threats to offline violence and of non-lethal attacks turning into lethal violence.



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On the morning of August 15 2021 the flourishing musicscape of Afghanistan fell silent. As the Taliban regime came back into force, musicians disappeared and fled through fears of being harassed, brutalised or murdered for their craft.

Working with Afghan composers, we staged a performance at the Spitalfields festival in London, where a British orchestra performed a programme of Afghan orchestral music. The works of nine Afghan composers were performed and eight of these nine were world premieres. We are continuing to work on promoting the flourishing of Afghanistan's orchestral music internationally by connecting and supporting Afghan musicians across the globe.



Research that changes lives

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During the Covid-19 pandemic misinformation and disinformation about the vaccine was shared extensively online, with potentially fatal consequences.

Our big data experts mined vast quantities of consumer-generated media to author two policy briefs for UNESCO about the viral disinformation helping to drive the pandemic. They also participated in an expert group alongside Facebook, Twitter, and Google to develop new measures to limit the spread of vaccine misinformation and disinformation.

The team went on to work with First Draft, an international network of journalists, news organisations, policymakers and social media platforms. They contributed data visualisation expertise to identify vulnerabilities and areas requiring intervention in order to promote integrity in the world's information ecosystem.



We cannot hope to shape our world for the better without inviting like-minded institutions, organisations and individuals from across the world to work with us.

From international businesses, to local SMEs, to patients volunteering in our clinical trials, here's what our partners say about us.



Brian Moran

Boeing Vice-President of Global Sustainability Policy and Partnerships



We are honoured to partner with the University of Sheffield on the UK's first major Sustainable Aviation Fuels hub, which highlights our global commitment to developing sustainable aviation fuels as a safe, proven, and effective solution to decarbonise aviation.”

David Latimer

CEO of Magnomatics



A lot of businesses talk about a skills shortage. We don't have that problem, we engage with students whilst they're still undergraduates allowing us to talent spot. I would encourage any other business in the region to make contact with the University and explore the possibilities, because for us it has made us the world-leader in our technology.”

Kim Streets

Chief Executive, Sheffield Museums



The very best of the region's arts, culture and heritage is developed and delivered through creative collaboration. The University's strategic role as a trusted partner has made great things happen – their work in supporting, commissioning and advocating for culture in all its forms has been pivotal.”

Colette Beacher

Participant in a clinical trial for Multiple Sclerosis treatment



Several of my symptoms have now disappeared – I no longer get spasms that go down my spine when I flex my head forward, and my right leg hasn't given way for three years. I now have the possibility of living a life without MS and contemplating a future without disability.”

To explore how you can collaborate with us go to [sheffield.ac.uk](https://www.sheffield.ac.uk)



New drug potential game changer for MND treatment

We believe a new genetically-targeted therapy to treat a type of motor neurone disease (MND) could be a game changer, after results of a Phase 3 clinical trial show significant improvement in patients' symptoms of the debilitating disease after 12 months.

MND, also known as amyotrophic lateral sclerosis (ALS) is a disorder that affects the nerves, or motor neurons. The progressive disease affects a patient's ability to walk, talk, use their arms and hands, eat and breathe. The Phase 3 clinical trial, sponsored by biotechnology company Biogen Inc. investigated patients whose MND was caused by a faulty SOD1 gene.

Professor Dame Pamela Shaw said: "I have conducted more than 25 MND clinical trials and this is the first time patients have ever reported an improvement in their motor function.

"Never before have I heard patients say 'I am getting better, I am doing things today that I couldn't do a few months ago – walking in the house without my sticks, walking up the garden steps, writing Christmas cards'. For me this is a real game changer."

SOD1 is the known cause for triggering MND in two per cent of all patients with ALS, and up to 20 per cent of patients who have a family history of the disease.

Dame Pam added: "Patients with SOD1 mutations are relatively rare, but this trial is going to change the future of MND trials for patients. Not only can we look at other genes which also cause MND, but we now have a biomarker which we can measure to see if a treatment is working.

"This is going to make trials much quicker and prevent patients taking a drug for months and months which isn't working – you will be able to tell in three or six months if it is having a positive effect."



University of Sheffield

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Explore more of our research impact

