Newcastle University
UK | Malaysia | Singapore

Research Impact

- Managing global water supplies
- Cutting global sugars consumption
- Inspiring the future of learning

Coral reef protection | Internationally celebrated sculpture | The power behind Wall Street | Treating kidney disease

Excellence with a Purpose

Spotlight on research excellence

By **Professor Nick Wright**
Pro-Vice-Chancellor for Research and Innovation
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From pioneering medical and scientific breakthroughs to shining a spotlight on global issues in health, the environment and society, the research we carry out at Newcastle University is helping to transform people's lives all around the world and influencing policymakers at the highest levels.

Our overriding ethos is that our research should respond to both local and global issues, so that the work we do makes a difference to society not only in our city and region, but also on a national and international scale. We are committed to excellence in our research, but excellence with a purpose. We believe that it is not enough simply to ask 'what are we good at?', but also 'what are we good for?'

This is why a significant part of our work is organised into three research challenge themes of ageing, social renewal and sustainability. These are disciplines in which we have strength and depth in expertise, and they are also themes that recur among the most pressing issues facing global society.

In the pages that follow, you will learn how our scientists and civil engineers are supporting the complex management of vital water resources in the Nile Basin and in Latin America, while others are providing solutions to protecting and restoring the world's precious coral reefs.

We also shed light on how the highly advanced technologies developed by our computing scientists and electrical engineers are improving the processes that drive decision-making in the world's largest organisations.

And as governments around the world strive to tackle the global obesity crisis and other health problems associated with a sugar-rich diet, find out how our research is helping influence their efforts to drastically reduce the amount of sugars people consume on a daily basis.

Visit www.ncl.ac.uk/research for more information about Newcastle University's world-leading research.

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Managing global water supplies

Researcher: **Dr Geoff Parkin**
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The management of water resources is a source of potential conflict all over the world, particularly where supplies cross a number of political boundaries. Newcastle University has earned a global reputation for applying solid science to help bring about resolutions to these issues.

Water is an essential natural resource that shapes landscapes, ecosystems and economies and is vital for human survival. As a resource, it has never been under more pressure, with demographic, economic and global climatic changes adding increasing stress to supplies.

The research and expertise of scientists and civil engineers at Newcastle University is proving invaluable for governments around the world preparing for flooding and drought, managing agricultural pollution and planning sustainable water management.

Our research is helping to share fairly the River Nile's 84 billion cubic metres of water

Dr Geoff Parkin

The team was called upon by the World Bank-funded Nile Basin Initiative to provide the first impartial assessment involving all riparian countries of the Nile Basin, one of the world's most complex and difficult to manage transboundary river systems.

They used advanced data management and modelling tools to establish how much water is in the Nile, as well as its flow and the impact of human interventions. The quality-assured data formed part of a new decision support system, providing the foundations of a new shared approach to water management by the nine countries on the banks of the River Nile.

Dr Geoff Parkin, Senior Lecturer in Hydrology, said: **"When a river crosses many national boundaries it will inevitably involve many political, social and economic issues that can be extremely challenging to resolve. The foundation of better management of international river conflicts lies in understanding the full picture of what is happening naturally with the water resource before considering what the impact of human intervention will be. We introduce solid science to help solve difficult practical problems – that is where our team really excels."**

In Latin America, research by the team has helped several countries, including Argentina, Ecuador, Chile and Costa Rica, to understand the role of forests in environmental protection against extreme rainfall and snowmelt.

In Argentina, the problems and solutions identified during the European Commission EPIC FORCE project, led by Newcastle University, were included as priorities in a national water resources plan.

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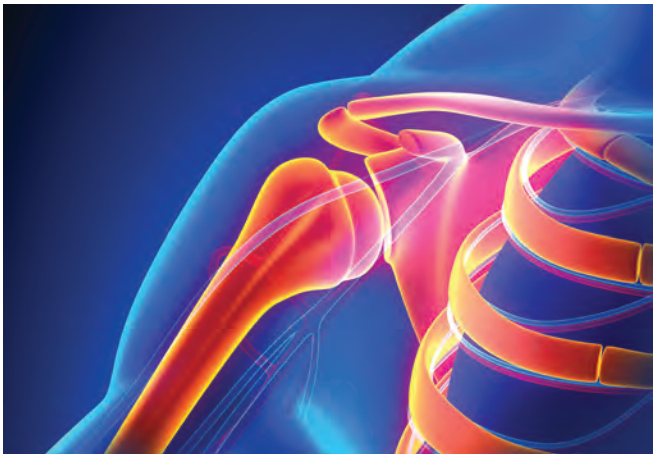

Musculoskeletal medicine

Researcher: **Professor Helen Foster**

Paediatric rheumatologists who developed a simple clinical skill to improve joint examination of children and recognition of childhood arthritis have gone on to launch a series of online resources to improve access to the right care.

An examination of the joints called pGALS (paediatric Gait Arms Legs and Spine) is now taught to medical students and is being used by doctors worldwide.

The Newcastle team responsible, led by Professor Helen Foster, is continuing to raise awareness of paediatric musculoskeletal medicine around the world with the launch of websites to address specific challenges encountered by paediatricians in the UK and India.

There are now plans to extend the reach of the advice with a website and apps designed to be accessed by medics anywhere in the world.

Visit pmmonline.org/doctor and pmmonlineindia.org

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Our research is speeding up diagnosis for the world's 2.2m children with arthritis

Professor Helen Foster

Inspiring the future of learning

Researcher: **Professor Sugata Mitra**
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A new model of learning developed by our academics is changing the culture of classrooms around the world.

Professor Sugata Mitra developed the concept of self-organised learning environments (SOLEs) following his 'Hole in the Wall' experiments, in which he placed a computer in a wall of an Indian slum and observed as children taught each other subjects from English to programming.

As the 2013 recipient of the $1 million TED Prize, Professor Mitra used the award and community resources to expand this work and create a structure in which children are guided to teach each other.

Professor Mitra's research has gone on to become a global phenomenon, its impact extending to 27 countries across five continents. His experiments even inspired Vikas Swarup's novel *Q&A*, on which the Oscar-winning film *Slumdog Millionaire* was based.

Teachers have also been inspired to find new ways of using enquiry-based learning to encourage students to work together, solve problems and become more engaged, with minimal intervention from educators.

A SOLE toolkit created for educators and learners has been downloaded more than 100,000 times and tens of thousands of SOLEs have taken place all over the world.

Professor Mitra has launched a series of 'School in the Cloud' learning labs to test the extent to which children in small groups, with access to a computer and when prompted by the right questions, can essentially learn on their own.

A school in Harlem has just opened the eighth School in the Cloud lab – the first of its kind in America – which now aims to build on the success of those already running in India and the UK.

The Harlem lab is being funded by Newcastle University, where Professor Mitra is Director of SOLE Central, the global hub for research and practice into SOLEs.

Skype Grannies

A team of 130 volunteers have so far been recruited to form the Granny Cloud, a global community of mediators who use Skype to work with children in SOLEs around the world.

The Skype Grannies are 'beamed' into the learning environment to stimulate children's curiosity, develop their confidence, and generally to have fun.

Contrary to what some people might think, the grannies are not teachers. Conversation is key to these interactions and each granny has his or her own style – that's what makes it so interesting for the children.

The Granny Cloud has been up and running since 2009 when Professor Mitra first put out an appeal in a UK newspaper for grandmothers with a spare hour a week who would like to talk to children in India via Skype and help them with their English skills.

There are a handful of loyal stalwarts still remaining from those early days, including a self-organised core team who help to recruit, interview and advise new members.

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Our inspirational research is changing the culture of classrooms around the world

Professor Sugata Mitra


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RESEARCH ONLINE AT
ncl.ac.uk/research/casestudies

The power behind Wall Street

Researchers: **Professor Alex Yakovlev and Professor Maciej Koutny**
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From the world's leading financial markets to the business processes of major organisations, research carried out by computing scientists and electronic engineers at Newcastle University is helping to solve problems faced by industry and commerce.

For the past 20 years, a cross-discipline team at Newcastle University has been bringing together expertise in causality modelling to find new ways of improving processes that touch our daily lives. Their research into this specific type of mathematical modelling allows them to estimate and forecast the outcome of a given situation based on the relationships between a number of variables. It can be used, for example, to establish whether a new piece of equipment will help alleviate bottlenecks in hospital services.

Their sophisticated hardware and software technologies now help complex organisations in fields such as healthcare, banking and manufacturing to handle and make sense of huge quantities of data and increase the accuracy of the decisions they make.

Transactions worth billions of pounds taking place every day on the New York Stock Exchange and the NASDAQ are powered by hardware made by Intel and designed with the help of research carried out at Newcastle.

This research was crucial to the worldwide adoption of asynchronous microprocessor chips, sometimes described as clockless chips because they don't use a clock to time the entire chip and can overcome resulting speed and power supply headaches. Financial traders now rely on these fast and powerful chips when analysing vast quantities of data and making split-second decisions on major deals.

Newcastle's expertise in process mining, a system which involves extracting knowledge from event logs, is now helping organisations to identify behaviours and consider the connections and causes between events. A toolkit created by the team has been used to analyse the event logs of more than 100 organisations, from ING Bank to Deloitte.

The substantial body of work has been led by Alex Yakovlev, Professor of Computer Systems Design, and Maciej Koutny, Professor of Computing Science.

Professor Koutny said: **"In our increasingly data-driven world the potential applications for the tools we have developed is endless. They could hold the key to solving everything from e-crime investigations to identifying bottlenecks in hospital services."**

Professor Yakovlev added: **"In the future new technologies and the Internet of Things will depend on close interaction between computers and the electrical devices we use. Without a common language between the two this could not progress. The fundamental research carried out at Newcastle University is helping to find the common ground between the two disciplines and accelerate the exciting progress being made."**

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Our highly advanced computing technologies power industries around the world

Professor Alex Yakovlev and Professor Maciej Koutny

Treating kidney disease

Researcher: **Dr John Sayer**
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Genetic research pioneered at Newcastle University offers new hope to people suffering from debilitating kidney problems.

Kidney stone disease is on the rise worldwide, with increases seen across gender, age and race. In the US one in every 11 people will experience kidney stones at some point in their life, white in Japan the rates have doubled over the past 40 years.

Academics from Newcastle working with colleagues at Harvard University have now found that many cases of kidney stones have a genetic cause.

The breakthrough, published in *Journal of the American Society of Nephrology*, means doctors will be able to treat some patients more effectively and screen others for the disease, which can cause extreme pain and lead to long-term kidney damage.

By tracing the DNA link, medics will now be able to identify patients and family members who are at risk of developing this serious condition and intervene with specific treatments.

Dr John Sayer, a kidney specialist at Newcastle University and Newcastle Hospitals NHS Foundation Trust, said: "Previously it was thought that about 1% of kidney stone cases were caused by genetic disease. But our study showed 15% of cases – a far higher and more significant proportion than expected – are related to DNA and this opens up new opportunities for treatments and diagnosis.

"Current treatments for kidney stones include medical and surgical options. In light of this research we now aim to direct medical treatment at the precise cause of the condition to avoid recurrent stones and the multitude of surgical procedures that are often needed."

A further breakthrough in renal research by the team has been hailed as the first step towards developing personalised medicine to treat Joubert Syndrome, a rare childhood disease that often leads to total kidney failure by the age of 13.

Findings published in the journal *Proceedings of the National Academy of Sciences* show that kidney damage in patients suffering from the condition is not permanent and can be treated. While further research and testing is still needed, it is hoped the results will provide the basis on which specific treatments can be developed.

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Kidney drug benefits patients with rare disease

Researchers: **Professor Tim Goodship and Dr David Kavanagh**

Patients with a rare life-threatening kidney disorder are now benefiting from research undertaken at Newcastle University which has been central to understanding the cause of the disease and ultimately to finding an effective treatment.

The drug, called Eculizumab, has been clinically proven to prevent kidney failure in people with atypical Haemolytic Uraemic Syndrome (aHUS), a serious irreversible illness which causes the tiny filters within the kidneys to become blocked by blood clots.

Research into the genetic factors underlying the disease led by Tim Goodship, Professor of Renal Medicine in the University's Institute of Genetic Medicine, was instrumental in the identification and testing of the pioneering treatment.

The National Institute for Health and Care Excellence (NICE) has now recommended the drug for use on the National Health Service (England). The guidance is the first to be produced as part of NICE's highly specialised technologies programme to evaluate treatments for very rare conditions.

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Our genetic research will help reduce the global rise of kidney stone disease

Dr John Sayer

Cutting global sugars consumption

Researcher: **Professor Paula Moynihan**
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Millions of people around the world stand to benefit from a global shift in nutrition advice informed by research at Newcastle University.

The amount of sugars consumed by industrialised and developing countries is stretching healthcare budgets as well as belts – impacting on obesity levels, tooth decay and people's wellbeing.

Scientists from Newcastle University are playing a key role in reversing this trend, with research that is influencing the efforts of policymakers, healthcare providers and the food industry to reduce consumption levels on a global scale.

Academics have been instrumental in a move by the World Health Organization (WHO) to recommend halving the threshold for the maximum amount of sugars people consume daily.

Their research revealed that, when less than 10% of calories in the diet is made up of free sugars, there are much lower levels of tooth decay. They went on to show that a further reduction to below 5% per day – the equivalent of six sugar cubes for an adult, and only three cubes for a young child – provides additional health benefits.

National policymakers across the world are now responding to this advice. Revised draft US dietary guidelines, issued in March 2015, proposed a 10% cap on an individual's consumption of added sugars based on the evidence from Newcastle University. This is the first time the country has ever put a numerical cap on sugars intake.

A major milestone was reached in September 2015 when the membership of FDI World Dental Federation – comprising some 200 national dental associations in 130 countries – voted to back the WHO guideline that contains recommendations.

Paula Moynihan, Professor of Nutrition and Oral Health at Newcastle University, carried out the study with co-author Dr Sarah Kelly, now at Cambridge University.

Professor Moynihan said: "Considerable action is now required to reduce sugars intake globally.

"Possible approaches include food manufacturers reformulating products. This has worked for salt reduction and we hope it might work for sugars too.

"More stringent regulation on marketing and advertising of products high in sugars is another area for potential action, as is the introduction of a tax on foods and drinks high in sugars.

"Our work aims to address the social inequalities that mean the most deprived members of society suffer the most extreme problems connected to the consumption of sugars."

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Guidelines at a glance

The World Health Organization's guideline now recommends adults and children reduce their daily intake of **free sugars** to less than 10% of their total energy intake. A further reduction to below 5% would provide additional health benefits.

What are free sugars?

Free sugars refer to sucrose (table sugar), fructose, gluose, galactose and maltose, added to food and drinks, and sugars naturally present in honey, syrups, fruit juices and fruit juice concentrates.

The WHO guideline does not refer to the sugars in whole fresh fruits and vegetables, and sugars naturally present in milk, because there is no reported evidence of adverse effects of consuming these sugars.

Where are they found?

Much of the sugars consumed today are **'hidden'** in processed foods that are not usually seen as sweets. For example, a single can of a sugar-sweetened fizzy drink contains around nine sugar cubes.

Statistics from World Health Organization advice

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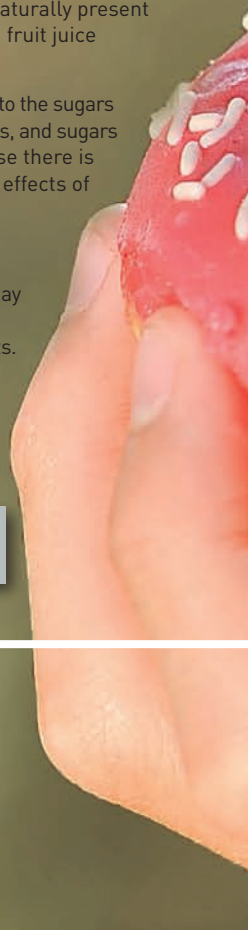

Our research shaped the World Health Organization's guideline to dramatically reduce the amount of sugars we consume

Professor Paula Moynihan

5%

of calories is the equivalent of six cubes of sugar for adults and three for children.

7-17%

In Europe, sugar intake in adults ranges from about 7-17% of total energy intake in countries like Hungary and Norway, to 16-17% in countries like Spain and the United Kingdom.

> **‘The amount of sugars consumed by industrialised and developing countries is stretching healthcare budgets as well as belts – impacting on obesity levels, tooth decay and people’s wellbeing.’**

Sugar intake – a global picture

Worldwide intake of free sugars varies by age, setting and country.

Intake is much higher among children, ranging from about

12% in countries such as Denmark, Slovenia and Sweden

to as much as

25% in Portugal

Creating conversation through sculpture

Researcher: **Professor Andrew Burton**

Professor Andrew Burton has achieved critical acclaim and popular support around the world with his unique approach to sculpture that challenges us to look at humble everyday objects in a new way.

Whether it's a chilli pepper, a ceramic brick or even a tower of cow dung, Burton's choice of media is as diverse as it is unusual. The temporary structures he creates from these materials reflect the crafts, techniques and people from the places he visits as he explores ways to recycle, re-use and reclaim.

From brick makers and bamboo breakers in India to beachcombers in China and graffiti artists in North America, Burton's research involves collaborations with local craftspeople and finds new audiences for their practices.

By shining a new light on material objects and skills that otherwise are considered commonplace, he aims to create new public conversations and practitioner debate about art, architecture, craft and the world around us.

Burton, who is Professor of Fine Art at Newcastle University, shares this practice-based research with tens of thousands of people around the world through international public exhibitions, commissions, lectures, presentations and publications. His work has reached large audiences and engaged niche communities.

For some of his recent work, Burton formed thousands of tiny bricks from clay and constructed them into various sculptures. Each sculpture would be painted or glazed, but then broken up and its constituent parts used to form a new piece. In this way the sculptures are continually recycled.

Burton's significant body of work focusing on bricks has been exhibited internationally and has attracted a string of coveted prizes. Most recently, his sculpture *Monument* secured both the judges' Gold Prize and the People's Choice award at the Korean Ceramic Foundation Awards in April 2015.

In Australia, his work *Vessel* was seen by 260,000 people in just three weeks when it was exhibited in Perth as part of Sculpture by the Sea 2015, the largest free public sculpture exhibition in the world. The work went on to win the event's Andrea Stretton Memorial Award.

A further 500,000 visitors are expected to see a new work by Burton in October when the *Sculpture by the Sea* event takes place in Bondi Beach, Sydney.

Finding beauty in cow dung

One of Profesor Burton's more unusual recent projects involved a collaboration with female dung workers from the village of Ghitorni, about 10 miles from the centre of New Delhi.

The project celebrated the little-known practice of making Bithooras – structures made from dried cow-dung shaped into flat cakes and decorated with intricate designs.

Profesor Burton said: **"Shaping the Bithooras is very physical, almost violent, slapping and pummelling the surface of the cakes. Then at the end the patterns are inscribed by hand.**

"There's no 'value' to these designs. The Bithooras are broken down almost as soon as they've been created so that the cow-dung cakes can be used as fuel, so making the patterns seemed to me an act of unalloyed creativity, done for no commercial gain, no long-term aesthetic pleasure, just for the action itself.

"This fascinated me and my interest in something that seemed so commonplace to the people who made them placed a new value on their work."

The project resulted in an exhibition of Bithooras at the Craft Museum Delhi.

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Our research in art shares hidden cultures with the world

Professor Andrew Burton

Protecting

Researcher: **Professor Alasdair Edwards**

Our research has helped change the way the world's precious coral reefs are protected and restored.

Coral reefs are the most biologically diverse ecosystems on earth. As well as preventing coastal erosion, coral reefs provide food and livelihoods for hundreds of millions of coastal people in over 100 countries, with an estimated value of US$375 billion per year.

This essential resource has survived tens of millions of years of natural change but many reefs are now being destroyed by the deliberate actions of mankind.

Despite their importance and the peril they face, very little work had been carried out to establish cost-effective methods of restoring damaged reefs prior to research by Newcastle University over the past 20 years.

Fast forward to today and reef managers, local governments and the maritime industry are using international guidelines shaped by the Newcastle team's findings and their collaborations with colleagues from Singapore, the Philippines, Thailand, Japan, Australia, the USA, Israel, Tanzania and Mexico.

The Newcastle team was the first to challenge the effectiveness of common coral transplantation strategies. These methods focused on attaching fast-growing coral species onto damaged reefs to speed their recovery. This cost on average US$0.5 million per hectare, and sometimes achieved little.

The team concluded that restoration techniques should be used as a last resort. Instead, they highlighted the resilience of the habitats once human impacts such as overfishing, pollution and careless tourism are managed, and campaigned for management as a priority.

Where restoration was deemed appropriate, the team highlighted the need for greater attention to the use of more robust, slow-growing coral species. They went on to develop cost-effective techniques for rearing coral from spawn for use in reef restoration.

The team devised innovative coral 'plug-ins' that work by rearing healthy baby corals on cement cylinders embedded with plastic wall plugs of the kind used to fit screws into masonry. The plug-ins are then slotted into pre-drilled holes in a damaged reef. Researchers hope they can eventually reduce the cost of this technique to a mere US$1 per coral.

As a by-product, this research has provided the tools for selective breeding of more temperature-tolerant corals that will give reefs a better chance of surviving the threat of global warming.

Alasdair Edwards, Emeritus Professor of Coral Reef Ecology at Newcastle University, said: **"Coral transplantation was being grossly oversold to reef managers as a panacea for coral reef degradation. On the one hand, we sought to improve the effectiveness and reduce the costs of restoration techniques; on the other, we wanted to inform managers where and when these new techniques could make a difference.**

Our research is helping to protect the world's coral reefs valued at US$375 billion a year

Professor Alasdair Edwards

coral reefs

"Huge areas of coral, equivalent to two and half times the size of Wales, have already been destroyed and yet restoration techniques only have an impact at scales of a few hectares at best. There was an enormous mismatch of ambition versus reality.

"Our research has significantly progressed understanding. We've shown that natural recovery will take place where local human impacts are managed. Better management is the main solution, transplantation is a last resort.

"The stark reality is that all tropical reef-building corals are under threat from global warming and from ocean acidification. A ray of hope lies in the use of selective breeding to develop thermally tolerant corals that can better cope with their changing environment. The knowledge and the tools are there now to make that happen."

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Research on the TV

A series of six hard-hitting televised debates featuring senior Newcastle University academics has been broadcast across South East Asia as part of Channel NewsAsia's influential *Perspectives* series.

Filmed in front of a studio audience, *Perspectives* brings together a panel of distinguished experts and leading thinkers from Singapore, Asia and beyond to dissect current events with in-depth analyses, engaging views and insightful comments on global events that will shape the future.

The episodes, which were filmed in Malaysia and Singapore, focused on issues including the future of oil, the future of cities and caring for ageing Asia.

Channel NewsAsia is an English language Asian TV News channel reporting on global developments with Asian perspectives. Its news and current affairs programmes are broadcast 24 hours a day in 26 territories, including Singapore and Malaysia, India, China and Australia.

The gift of the storyteller

Researchers: **Dr Jessica Sage, Dr Lucy Pearson and Dr Anne Whitehead**

Newcastle University and Seven Stories, The National Centre for Children's Books in Newcastle, are to collaborate on a project to celebrate the work of renowned children's writer, Michael Morpurgo.

Coinciding with the news that Seven Stories has been given custodianship of the Morpurgo archive, the organisation has embarked on a Knowledge Transfer Partnership (KTP) with the University's School of English Literature, Language and Linguistics (SELLL).

KTP is a Government-run programme which helps businesses improve their competitiveness and productivity through the knowledge and skills that reside within UK universities. This new project is one of very few KTPs between a university English literature department and an external organisation, and is being funded by the Arts and Humanities Research Council (AHRC).

The Morpurgo archive contains draft manuscripts, photographs, notebooks and related correspondence from his body of work.

As part of the KTP, Dr Jessica Sage from SELLL, along with Dr Anne Whitehead and Dr Lucy Pearson, will work with Seven Stories to provide expert insight into the ways in which the former Children's Laureate and award-winning author of *Warhorse* constructs his stories and the implications this has for our understanding of children's literature.

The project will culminate in a brand new exhibition that will open in Newcastle in July 2016, followed by a national tour. The exhibition will explore Morpurgo's storytelling and will celebrate the impact of his poignant tales on a nation of young readers.

Michael Morpurgo with Sarah Lawrence, Collection and Exhibition Director at Seven Stories.

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A series of hard-hitting televised debates on global issues features our academics

Serving up healthy eating habits

Researcher: **Professor Ashley Adamson**
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Children are now enjoying tasty and healthy school meals thanks to the introduction of a set of food standards informed by the research of Newcastle University Professor of Public Health Nutrition, Ashley Adamson.

The Government's School Food Standards were based on the advice of the School Food Plan expert group and standards panel, of which Professor Adamson is a member.

The standards include guidelines that give cooks greater freedom to create their own menus while also ensuring pupils get the fuel they need to help them concentrate and build healthy eating habits for life.

They also set out a series of minimum requirements for all food served in schools to ensure children are eating high-quality, nutritious food, while restricting intake of sugars, pastries and fried foods.

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Mathematical research equals fairer energy bills

Researcher: **Dr Shirley Coleman**

Energy bills in the UK are now fairer, and millions of pounds have been correctly re-allocated, thanks to mathematical research that has improved issue identification for National Grid gas.

Dr Shirley Coleman, of Newcastle University's Industrial Statistics Research Unit, led work to address discrepancies in the accounting of gas caused by complex issues in the system, including meter errors, undetected leaks and weaknesses in measurement.

Working with analysts from National Grid, researchers used their findings to design tailored fault-finding procedures and new methods to analyse data. This work has greatly influenced the way UK gas distribution networks value their data and they are increasingly adopting data analytic practices.

In one year alone, the new data mining techniques highlighted meter errors which resulted in £14 million being returned to the community.

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Northern Powerhouse

The Government's destination marketing agency, Visit Britain, has produced a video promoting the strengths of the North.

The Northern Powerhouse film is aimed at potential investors and will be used internationally to raise awareness of the business, research and cultural assets in the North. The academic credentials of the North's research-intensive universities will feature in the film, which includes specific footage of Newcastle University's medical research.

Our research means energy bills are now fairer and more accurate

Dr Shirley Coleman

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