



UNIVERSITY OF  
LINCOLN

# Research

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Research is critical to our mission and central to what we do. Growth in research capacity and performance will position Lincoln to fulfil its mission to support transformational change in society.

**Professor Mary Stuart**  
Vice Chancellor

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# Research Mission

At the University of Lincoln, research underpins all our academic endeavours. It enables us to discover, create, disseminate and preserve knowledge. It is our mission to pursue the highest standards of research excellence with the most talented academics, researchers and students attracted from across the UK and abroad.

**T**hrough continued development and investment, the University of Lincoln supports a vibrant culture of inquiry and initiative, building leadership and research capacity in scholarship and professional practice.

The University of Lincoln is an institution that believes in research that makes a difference. With our strong public mission and a passion for partnership, we have developed an unparalleled place to study and research, where an innovative, open and collaborative culture for scholarship thrives.

### How do we get there?

To achieve our ambitions, the University is focusing its efforts on further strengthening the way we support our research. To do this we must attract, recruit and retain talented new staff, while continuing to support and develop our existing staff. To this end, we are looking closely at the future support we give to our academics to help improve and diversify their engagement in research, as well as supporting them to meet our expectations for raising income, improving the quality of outputs and extending the reach and impact of our research.

The profile of our research portfolio that has emerged from the 2014 Research Excellence Framework has given us the chance to set those principles and

practices firmly in place and to support staff in shaping their personal and collective research plans for the next five years.

In preparing our new Research Plan, we are looking to enhance our expertise towards the development of highly innovative and forward-thinking research centres, where partnerships between academics from different disciplines, and the wider external world, can come together. This will encourage our academics, researchers and students to pursue an enhanced scholarly experience, based upon collegiality and cross-disciplinary research in a supportive and creative environment.

You can see this evidenced in the selection of case studies in this brochure.

A university is defined by the profile of its research and its teaching and the two are inextricably linked. We are proud of the diversity across our academic schools and the richness it creates in our research and scholarship. We are an ambitious university, and we have the determination and the energy to pursue excellence wherever we find it.

**Professor Ieuan Owen**  
Deputy Vice Chancellor  
University of Lincoln

“With our strong public mission and a passion for partnership, we have developed an unparalleled place to study and research, where an innovative, open and collaborative culture for scholarship thrives.”





# A Rich Research Environment

The University of Lincoln sits at the heart of an historic city, making its award-winning campus and resources easily accessible to business and the wider community.

Over the last 10 years, there has been significant investment in the infrastructure for both research and teaching, but it is the targeted investment in the research environment that has enabled the University to attract high-quality staff, creative and productive students, and successful business collaborations.

From state-of-the-art equipment and new buildings through to investment in facilities and archives, the University offers a vibrant academic environment in which to pursue research and undertake research-informed study.

In addition to a wide array of physical resources and facilities, there is a range of annual investments in research at both College and University levels. A University-wide Research Investment Fund assists with the development of strategic research opportunities, nurturing and promoting the creation of new knowledge that is of benefit to the wider community – regionally, nationally and internationally. Alongside this, College research funding supports smaller-scale activities that contribute to high-quality research outputs.

These funds are available to encourage our academics to reach their full research potential, build research teams, explore new and innovative areas of inquiry, and raise the impact and profile of their outputs.

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The University is committed to developing research and scholarship that fosters a vibrant culture in which to work and study. As this dynamic culture grows, research begins to infiltrate everything we do – enhancing partnerships, improving interdisciplinary thinking and, in turn, making a visible contribution to wider society.

**Dr Lisa Mooney**  
University Dean of Research

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# Research Centres and Groups

The University's Research Centres and Groups sit at the heart of our research agenda and are responsible for much of our research outputs and performance.

As key sites of research inquiry and scholarship, they form the rich, collegiate environment where the research carried out by our academics, students and partnerships is underpinned and nurtured.

In January 2011, the University approved the establishment of new, clear and definable parameters for academic research at Lincoln. We defined minimum research and income generation standards for all academic staff in order to strengthen and continuously improve our research performance.

To establish the University's standing and increased reputation for quality research and strategic partnerships with funders, government and business, we have given specific attention and status to the establishment of prestigious centres of research quality.

At Lincoln, we have chosen to actively place our Research Centres and Groups at the heart of our strategic plans, marking them as critical to the University's research outputs and performance. We have recently been through a review of our Centres and Groups to establish a clear support structure for both investment in, and development of, our research expertise and thematic priorities.

This framework for how our Centres and Groups are positioned establishes highly visible and active communities of scholars and stakeholders engaged in high-impact research.

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## Our Research Centres are:

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### College of Science

- Lincoln Centre for Autonomous Systems
- Lincoln Social Computing Research Centre
- Laboratory of Vision Engineering.

### College of Social Science

- Policy Studies Research Centre
- Research, Enterprise and Innovation Centre.

### College of Arts

- Centre for Architectural Research
- Centre for Art & Design Research
- Centre for Conservation and Cultural Heritage
- Centre for European Cultural Studies
- Centre for Research in Journalism.

In addition, there are more than 30 Groups across the three Colleges with strong thematic priorities.

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For details about the University's many Research Groups and more in-depth information about the Centres, please visit [www.lincoln.ac.uk/researchcentres](http://www.lincoln.ac.uk/researchcentres)





# Working with our Researchers

At the University of Lincoln, we understand that the best research outcomes are achieved through collaboration.

The University is keen to explore where new partnerships might work to uncover original areas of research, or contribute innovative knowledge or cutting-edge solutions to critical problems and challenges faced by business or the wider community.

We work with a wide range of organisations, from small and medium-sized businesses through to public sector bodies, governments and multinationals. With access to a wide range of research centres and networks throughout the academic world, our researchers provide tailored expertise through blue sky and applied research, consultancy and knowledge exchange.

If you have an issue or project which you think our experts might be able to help you with, please get in touch. You can find out more about how we can work with you on page 56.

## Twitter Garden Takes Chelsea Gold

A unique collaboration bringing together computer scientists, psychologists, architects and garden designers was awarded a prestigious Gold Medal at the RHS Chelsea Flower Show 2013.

The University of Lincoln's Digital Capabilities garden invited the public to consider how social media intersects with the physical world by giving them the opportunity to shape the garden through Twitter.

Professor Shaun Lawson from Lincoln's School of Computer Science developed the initial concept and brought it to life with a team of colleagues across the University in Computer Science, Psychology and Architecture, in collaboration with garden designers Harfleet & Harfleet.

The garden generated high levels of interest among show visitors and received global media attention.

## Improving Pre-hospital Care for Emergencies

A programme led by academics from the University's Community and Health Research Unit has improved frontline care for people suffering from stroke and heart attacks.

The project, led by Professor Niroshan Siriwardena, aimed to advance the quality of urgent and emergency care, particularly pre-hospital care provided by ambulance services. It has led to evidence of gaps in service quality, initiatives to address these and improved care for sufferers of heart attack, stroke, asthma and diabetes across ambulance services in England.

The research has changed national policy and practice. The first national clinical indicator set for ambulance services, developed by the group, has enabled better regulation and has raised performance quality.

Stained glass fragments from the Old Cathedral of St Michael in Coventry, now on public view after 70 years in storage.



## Piecing Together the Past

Specialists from the University of Lincoln's conservation consultancy division, Crick Smith, are working with World Monuments Fund Britain and Coventry Cathedral to restore and put back on public display Britain's largest collection of loose fragments of medieval stained glass.

The Old Cathedral of St Michael at Coventry was bombed almost to destruction during the Second World War and its ruins now sit alongside the city's modern cathedral. The historic building's stained glass survived the Blitz, having been removed and placed in storage in 1939, hidden from public view for more than 70 years.

Some of the glass is by 15th Century Coventry-based stained glass artist John Thornton, best known for the Great East Window of York Minster.





# Changing the World

The University of Lincoln produces a range of research outputs that span the disciplines across our three Colleges. The following case studies are just some of the highlights of research that are having a positive impact on people's lives.

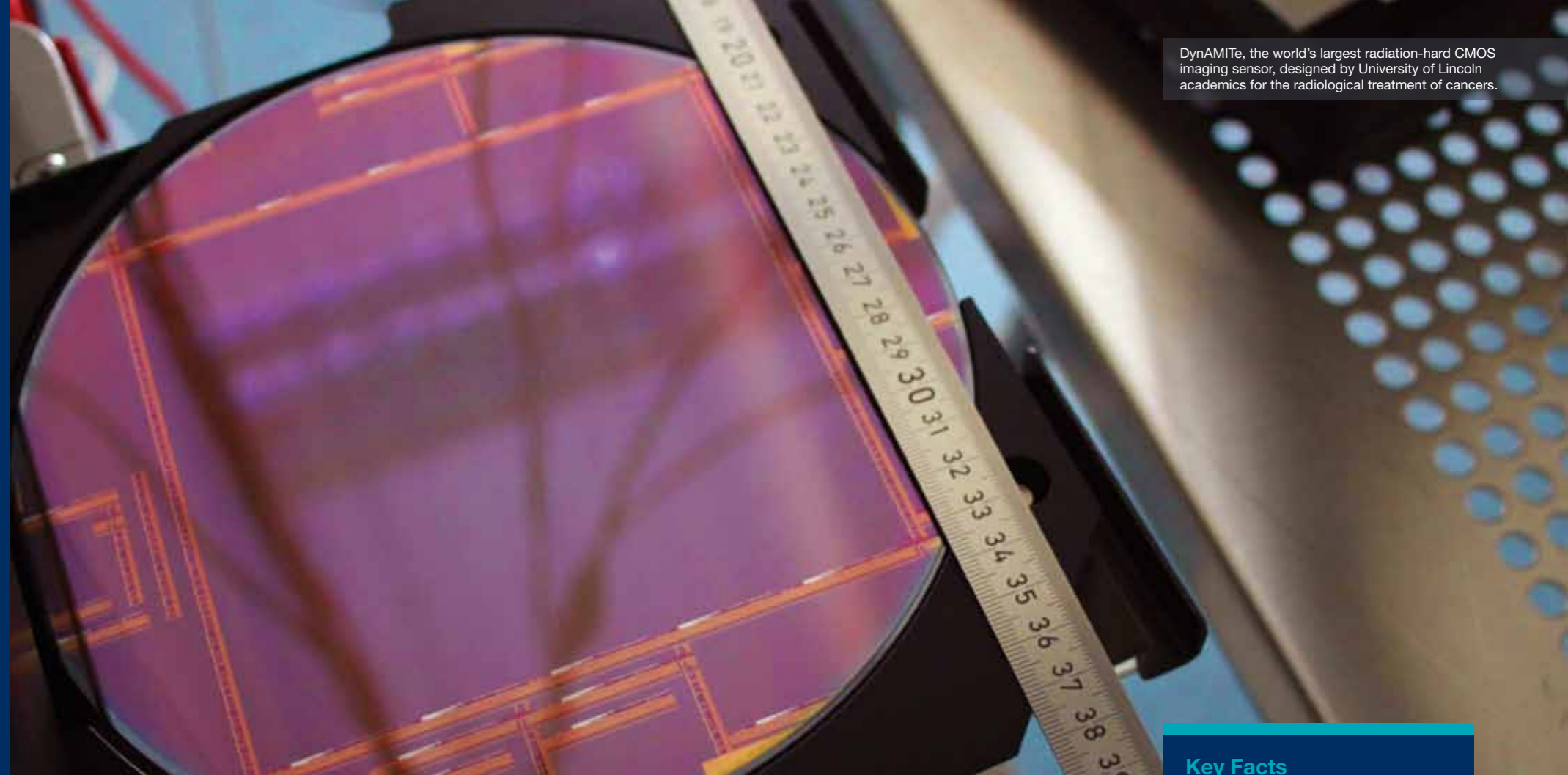
For the latest news and developments in research at the University, please visit [www.lincoln.ac.uk/research](http://www.lincoln.ac.uk/research)



# Imaging Technology in the Fight Against Cancer

Professor Nigel Allinson MBE

An internationally renowned expert in image engineering based at the University of Lincoln has developed new medical imaging technology that could revolutionise cancer treatment.



DynAMITe, the world's largest radiation-hard CMOS imaging sensor, designed by University of Lincoln academics for the radiological treatment of cancers.

A consortium, led by Distinguished Professor of Image Engineering Nigel Allinson, created DynAMITe, the world's largest radiation-tolerant silicon imager – 200 times larger than the processing chips that lie at the heart of current PCs and laptops.

The images it produces show the impact of radiation on tumours very clearly, as well as assisting detection in the earliest stages of disease progression.

DynAMITe was designed primarily for medical imaging, in particular for mammography and radiotherapy. It was funded by a £1.2 million grant from the UK Engineering and Physical Sciences Research Council (EPSRC).

The research also involves medical physicists at the Institute of Cancer Research and University College London, with clinical trials for prostate cancer

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Professor Allinson's work has the potential to make this revolutionary form of treatment a viable option for thousands of cancer sufferers.

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radiotherapy being undertaken at The Royal Marsden Hospital.

Image Sensor Design and Innovation Ltd (ISDI) was formed as a result of the project. ISDI has signed agreements with a global medical technology company for the exclusive design and provision of all future large area imagers.

Three international patents have been submitted and DynAMITe won the UK's Institution of Engineering and Technology's 2012 innovation award for electronics.

The initial development of the technology was funded by previous grants from the EPSRC totalling £8.7 million. More recently, the £1.6 million translation grant for the PRaVDA project was awarded by the Wellcome Trust.

The PRaVDA project, also led by Professor Allinson, will combine the imaging techniques developed at Lincoln with detectors

produced at the University of Liverpool to develop unique medical imaging technology that will provide accurate proton therapy doses and 3D images of where radiation is absorbed at a tumour site.

Proton therapy has emerged as the most promising alternative to conventional radiotherapy. Unlike x-rays, very little radiation is lost as a proton beam travels through healthy tissue on course to the target cancer cells. This means much higher doses of radiation can be delivered, without the risk of damaging healthy tissue.

Its combination of improved accuracy and potency makes proton therapy the preferred (and sometimes only) choice for treatment of cancers which lie close to vital structures in the body, such as the spinal cord or brain. It is useful for treatment of young children as there is much less likelihood of the development of secondary cancers later in life.

Professor Allinson's work has the potential to make this revolutionary form of treatment a viable option for thousands of cancer sufferers. Radiotherapy would be shorter and more effective and there would be opportunities to combat some common cancers that have resisted conventional treatment. Being able to see how radiation interacts with a tumour in 3D is considered to be the 'holy grail' of radiotherapy.

Professor Allinson leads a team of image engineers at the University of Lincoln and is Visiting Chair of Materials at the University of Oxford.

In addition, he has led a number of high-profile forensic science projects within the criminal justice system and homeland security. Technology related to forensic investigations that he developed is currently in use by three-quarters of UK police forces.

## Key Facts

### Wafer-scale CMOS Imagers for Medical Applications

#### Research Centre/Group

Laboratory of Vision Engineering

#### Staff Involved

Professor Nigel Allinson MBE, Dr Thalys Anaxagoras and Dr Grainne Riley

#### Points of Interest

The research has received several large grants, including a translation grant and further awards from the EPSRC totalling almost £10 million, and a £1.6 million award from the Wellcome Trust.

Professor Allinson was awarded an MBE for Services to Engineering in 2012.



# Reducing Risk for Maritime Helicopters

Professor Ieuan Owen

Research by a professor of mechanical engineering based at the University of Lincoln is informing the design of the next generation of combat ships being constructed for the Royal Navy.



Conceptual design of a littoral combat ship from Team Lockheed Martin.

Professor Ieuan Owen, Deputy Vice Chancellor at the University of Lincoln, has been a leading international figure in the simulation of helicopter launch and recovery from naval ships for over a decade.

Landing a helicopter on a ship in rough weather is one of the most dangerous tasks a pilot can undertake. As well as deck motion and reduced visibility, the air moving over the ship, caused by the combined effects of the ship's forward speed and the prevailing wind, creates a strong unsteady flow field (airwake) in the lee of the superstructure. This buffets the helicopter during approach and landing.

Working with colleagues at BAE Systems, the aerodynamics laboratory of the Canadian National Research Council and

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Professor Owen and his collaborators have been commissioned by BAE Systems to apply this research to the new Queen Elizabeth aircraft carrier, and by the Ministry of Defence to apply it to unmanned air vehicle launch and recovery from ships.

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the University of Liverpool, Professor Owen developed simulation facilities that are able to measure the effect of a ship's airwake on a helicopter.

Using computer-aided drawings of the ships and advanced unsteady computational fluid dynamics, Professor Owen has been able to compute the complex airwake and then impose this flow onto a computer model of a helicopter. Using these techniques, it is possible to quantify the aerodynamic loads on the aircraft and thereby evaluate how the design of the ship's superstructure affects the helicopter during take-off and landing.

These techniques are now being applied to future combat ships that are currently in the design phase, and structural

modifications are being made to improve the helicopter's operational envelope.

Professor Owen and his collaborators have been commissioned by BAE Systems to apply this research to the new Queen Elizabeth aircraft carrier, and by the Ministry of Defence (MoD) to apply it to unmanned air vehicle launch and recovery from ships.

The potential impact of this research was identified in its early years by the MoD, and Professor Owen was invited by them to be a UK representative on the Aerospace Systems Group of the Technical Cooperation Programme – a body with representatives from the defence agencies of the UK, US, Canada, Australia and New Zealand. A major part of the Group's work is

to coordinate and disseminate international research into maritime helicopter operations.

Professor Owen also represents the UK on the NATO technical working group AVT-217, which is seeking to provide ship design guidance for aircraft operations.

He collaborates with research teams in Canada and the US, and was funded by the Engineering and Physical Sciences Research Council (EPSRC) to travel to these countries to share his research and develop new projects.

Professor Owen's research has been widely published. He recently received the Gold Award from the Royal Aeronautical Society for the best paper published in *The Aeronautical Journal* in 2012.

## Key Facts

### The Aerodynamic Design of Future Combat Ships for Maritime Helicopter Operations

#### Research Centre/Group

Industrial Power and Energy Group

#### Staff Involved

Professor Ieuan Owen

#### Points of Interest

Funded by the EPSRC, with external partners including BAE Systems and the Ministry of Defence.

Other collaborators include the US Navy, the defence agencies of Canada and Australia, and the University of Liverpool.



# Training Computers to Inspect Food

Professor Tom Duckett

A new multi-purpose computer vision system to identify sub-standard food products has been created by a team of computer scientists at the University of Lincoln.



Professor Tom Duckett's research has developed a multi-purpose, user-trainable software technology, which has a range of possible applications and overcomes the specificity and other limitations of existing visual inspection systems. The research is achieving impact in several areas within the food industry, including quality analysis of fresh produce, food processing and food packaging.

The technique was initially developed by Professor Duckett using off-the-shelf hardware to enable affordable detection, identification and quantification of common defects affecting potatoes.

Academics from the Lincoln Centre for Autonomous Systems worked with the UK's Potato Council to produce a low-cost system which can assist quality control staff and improve consistency,

speed and accuracy of defect identification and quantification.

The British potato industry is worth around £3.5 billion a year and potatoes account for 40 per cent of carbohydrates consumed in the UK.

The main factor affecting consumer preference is physical appearance, with clear unblemished skin a significant selling point. Most potatoes are sorted into different grades by hand, often resulting in mistakes and losses.

To combat this, the new system was trained to recognise different blemishes and analyse potatoes in near-real time. It uses a low-cost vision sensor and a standard desktop computer with a graphics processing unit, together with software algorithms, to automatically learn the appearance of different defects in potatoes.

Relying on initial input by an expert, the technology can then learn to autonomously identify blemishes, diseases and good specimens in batches of potatoes.

The prototype has been trialled for analysis of potatoes and other crops in storage at Sutton Bridge Crop Storage Research – the leading post-harvest applied research facility for agricultural storage in the UK. Further developments include extending the basic technology to incorporate 3D sensing.

A second arm of Professor Duckett's research employs laser scatter imaging and polarised light stress images to detect faults in the heat seals of food packaging. Heat-sealed packs perform a number of functions in addition to containing food, such as preventing damage and atmosphere modification to keep contents fresh.

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Relying on initial input by an expert, the technology can then learn to autonomously identify blemishes, diseases and good specimens in batches of potatoes.

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A study of 105 packaging facilities concluded that, in the UK alone, a potential 480,000 tonnes of food waste per year is generated through unsound seals in food packaging.

The results of a research project funded by the Department for Environment, Food and Rural Affairs (Defra) demonstrated the potential for the development of a commercially viable, non-contact seal inspection method. This method could be implemented in the majority of tray packing processes, improving the detection of unsound packaging seals and thereby reducing waste.

Professor Duckett is now working with industry leaders, Ishida Europe Ltd, the Potato Council and Branston Plc, to apply these findings to create new multi-purpose imaging technology to automate quality inspection tasks in food processing and packaging. The project is funded by an £823,000 grant from the Technology Strategy Board.

## Key Facts

**Applying Research on Trainable Visual Anomaly Detection & Diagnosis to Quality Inspection Tasks in the Food Industry**

### Research Centre/Group

Lincoln Centre for Autonomous Systems (L-CAS)

### Staff Involved

Professor Tom Duckett, Michael Dudbridge and Dr Grzegorz Cielniak

### Points of Interest

Funding sources include the Engineering and Physical Sciences Research Council, the Potato Council, EMDA, Defra, the HIRF Innovation Fellowship and the Technology Strategy Board.

This research is currently being trialled at Sutton Bridge Crop Storage Research, the leading post-harvest applied research facility for agricultural storage in the UK.



# Pheromonotherapy and Animal Behaviour

Professor Daniel Mills and Helen Zulch



A team of animal behaviour experts at the University of Lincoln has pioneered research into how pheromone therapy can be used to encourage desirable behaviour in small animals.

**W**e may not be sure how our pets experience stress, but we know that emotional upset can have a significant impact on their lives. For this reason, more emphasis is being placed by researchers, veterinarians and the public on what can be done to alleviate the effect of different types of stress on animals' emotional and physical health.

Pheromones are a form of chemical signal produced by a huge variety of species throughout the animal kingdom. They are released by animals into their environment and can affect their own behaviour and that of other animals.

Professor Daniel Mills and his colleagues from the School of Life Sciences at the University of Lincoln have been at the forefront of an emerging field of veterinary behavioural medicine, which explores the use of biological

chemo-signals (pheromones) to regulate the behaviour and emotional state of animals (pheromonotherapy).

Lincoln's renowned team of animal behaviour experts has been carrying out extensive research in this area for more than 15 years.

Since the publication of its first independent study on the use of the synthetic fraction of feline facial pheromones to reduce urine spraying in cats in 1997, the group has steadily developed new benchmarks for the evidence of potential therapeutic interventions, culminating in the first meta-analysis in the field. This involved collating and reanalysing all published studies to evaluate their true effect.

The team has pioneered the development of a novel delivery system in the form of a diffuser, which can be used to release the

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The RSPCA is among many animal charities to acknowledge the team's research and most key textbooks on the subject now cite the use of pheromones in mainstream veterinary practice, as a result of their work.

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dog-appeasing pheromone or the feline facial pheromone. This can be used to reduce anxiety in the veterinary clinic and to reduce separation distress in puppies.

As a result of these and other developments, pheromonotherapy is now a multi-million pound international industry.

The simplification of animal behaviour therapy, so that it can be easily incorporated within veterinary practice and used by a wider selection of the public, has been another strategic goal of the team at Lincoln.

To this end, the team has pioneered a clinical approach to allow more reliable and specific diagnosis of problems, which is taught on an MSc programme and is presented in a new book, *Stress and Pheromonotherapy in Small Animal Clinical Behaviour*, published in 2012 by Wiley-Blackwell.

The RSPCA is among many animal charities to acknowledge the team's research and most key textbooks on the subject now cite the use of pheromones in mainstream veterinary practice, as a result of their work.

Professor Mills is a European and Royal College of Veterinary Surgeons Recognised Specialist in Veterinary Behavioural Medicine. Over the past 15 years, he has coordinated independent trials of potential new products in addition to developing his own initiatives, which focus on improving behaviour while safeguarding welfare.

Helen Zulch is programme leader on the MSc Clinical Animal Behaviour at the University of Lincoln and a consultant at the University's specialist Animal Behaviour Referral Clinic.

## Key Facts

**Using Chemical Signals to Prevent and Treat Problem Behaviour in Domestic Pets**

### Research Centre/Group

The Animal Behaviour, Cognition and Welfare Research Group

### Staff Involved

Professor Daniel Mills and Helen Zulch

### Points of Interest

Funding has been received from global industry leader Ceva Santé Animale (previously Sanofi Santé Nutrition Animale).

This research resulted in a book, *Stress and Pheromonotherapy in Small Animal Clinical Behaviour*, co-authored by Professor Mills, Helen Zulch and Dr Maya Braem Dube of the University of Bern, Switzerland.



# Reducing Heart Attack Risk with Vaccinations

Professor Niroshan Siriwardena

Research led by a University of Lincoln academic has found that patients who have the seasonal influenza vaccine could reduce their risk of having a heart attack by up to a fifth. The work is changing the way the medical profession and the public perceive the threat from the flu virus and has helped doctors improve uptake of the seasonal vaccine.



Seasonal influenza is directly responsible for around 12,000 deaths each year in the UK. People aged over 65 and those with chronic medical conditions such as asthma, chronic bronchitis or diabetes are particularly prone to developing complications from flu, such as pneumonia; but the link between influenza and heart attack or stroke following flu is less well understood.

Many flu-related deaths are preventable as a safe, effective flu vaccination is offered by the NHS to eligible people at the start of the flu season each year. The vaccine must be given anew every year, because the flu virus constantly evolves and new strains emerge.

With funding totalling almost £250,000 from the National Institute of Health

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One study indicated that having the seasonal flu vaccine could reduce people's chances of suffering a first heart attack by a fifth.

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Research, the work of Professor Niroshan Siriwardena and colleagues in Lincoln's School of Health and Social Care has helped to transform the way the medical profession and the public view the risks and the necessary response to the threat from flu complications.

For almost a decade, the University's Community and Health Research Unit has worked closely with GPs, practice nurses and other primary care professionals to find the best strategies for increasing uptake of the seasonal flu vaccine.

They have identified common obstacles that prevent at-risk groups getting the jab and devised new campaigns to bring them on board. An educational outreach programme was developed to share the best examples in medical practices.

The effects were profound. In a localised study involving 32 practices in one primary care trust area, flu vaccinations among over-65s increased by almost a quarter. Subsequent studies in other parts of the country showed similar impact.

The research of Professor Siriwardena and his colleagues has raised public awareness, not just in the UK but across the world, about the importance of the seasonal flu vaccine in preventing complications such as heart attacks.

Diseases of the cardiovascular system are the biggest cause of premature death in developed countries, accounting for one in three deaths in the UK. Many researchers believe the risk of suffering a heart attack or stroke is increased when people are suffering from a respiratory infection, such as flu.

One of the team's studies, published in the *Canadian Medical Association Journal* in 2010, indicated that having the seasonal flu vaccine could reduce people's chances of suffering a first heart attack by a fifth.

The findings, which were reported in the media around the world, underlined the importance of people in at-risk groups getting the vaccine. Uptake among over-65s and other at-risk groups in the UK has continued to increase.

Further research by the team at Lincoln includes a large case-control study investigating the potential for influenza and pneumococcal vaccination to reduce the risk of stroke, funded by the National Institute of Health Research.

## Key Facts

### Improving Influenza and Pneumococcal Vaccination Rates in Primary Care

#### Research Centre/Group

Community and Health Research Unit

#### Staff Involved

Professor Niroshan Siriwardena and Dr Zahid Asghar

#### Points of Interest

Funding sources include multiple large grants from the National Institute of Health Research.

External partners include Dr Carol Coupland, University of Nottingham; Stella May Gwini, Monash University; Dr Matthew Dexter, Retford Health; Dr Laura J Dexter, Dr M Dawn Teare and Professor Robert C Read, University of Sheffield.



# Improving Treatment for Insomnia Sufferers

Professor Niroshan Siriwardena

Research into insomnia carried out by a team from the University's School of Health and Social Care has led to better provision for sufferers on a national scale.



Insomnia affects 30 to 40 per cent of adults in any one year with 10 per cent affected by chronic or recurrent symptoms, leading to impaired quality of life, work absence, poor work output and economic consequences.

There is longstanding evidence of inappropriate prescribing of hypnotic (sleep-inducing) drugs in primary care, which the research group, led by Professor Niroshan Siriwardena, aimed to tackle.

The members of the Community and Health Research Unit at the University of Lincoln used a range of methods, including systematic reviews, surveys, interviews and controlled clinical studies. They aimed to investigate aspects of the quality of care for insomnia to improve care provision through innovation, quality improvement and service redesign, and to evaluate the effects of interventions.

The research found that GPs frequently prescribed sleep-inducing drugs early on in treatment, despite hypnotics being known to do more harm than good, especially in the elderly. And despite practitioners' reluctance to recommend psychological treatments for insomnia, patients were open and positive to these approaches.

A novel approach to managing sleep problems in primary care was developed as part of the study, using careful assessment and patient-focused treatment, including cognitive behavioural therapy.

As a result, clinicians have moved away from prescribing drugs to using psychological therapies for insomnia, which is a cultural shift in clinical behaviour towards greater involvement of patients.

The research has directly affected GPs' and primary healthcare professionals'

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practice, including changes in sleep management and reduced prescribing of hypnotic drugs. It has been disseminated through seminars, workshops, a national conference and an e-learning programme developed by the research team.

The findings have led to national changes in health service policy and practice, and have been incorporated in policy information, educational resources and guidance to clinicians on hypnotics prescribing.

There is now greater public awareness of better sleep management nationally and internationally through media coverage, including a national UK television documentary in which the research team took part.

Initially, the work had local impact in Lincolnshire in 2009, where the team

compared development of a new model of care for insomnia within 16 GP practices.

From 2011, the research began to have a wider regional impact on the NHS through seminars for GPs on management of insomnia in Lincolnshire, Chesterfield, Leicester, Nottingham and Derby.

The group also presented its findings at a national event run by the Royal Society of Medicine and the Mental Health Foundation.

The funding sources for the research programme on insomnia are all peer-reviewed competitive awards from organisations such as the Engineering and Physical Sciences Research Council (EPSRC), the Health Foundation and the East Midlands Health Innovation and Educational Cluster. These have collectively contributed to almost £1 million of investment.

## Key Facts

### Improving the Primary Care Management of Insomnia

#### Research Centre/Group

Community and Health Research Unit

#### Staff Involved

Professor Niroshan Siriwardena, Jo Middlemass, Fiona Togher, Viet-Hai Phung, Coral Sirdifield, Dr Zowie Davy, Professor Irving Kirsch and Professor Roderick Ørner

#### Points of Interest

Funding sources include grants from the Health Foundation, the Chief Scientist Office, Scotland, and the EPSRC.

External partners include Lincolnshire Primary Care Trust, and the East Midlands Mental Health Research Network Hub.



# Influencing Parliamentary Reform

Professor Hugh Bochel and Dr Andrew Defty

Research carried out by leading political commentators from the University of Lincoln is proving central to government policy on significant areas of parliamentary reform, expertise and scrutiny.



The debate on parliamentary change was reignited and brought to the fore by the previous Labour and current Coalition governments. A number of studies by Professor Hugh Bochel and Dr Andrew Defty, of the University of Lincoln's School of Social and Political Sciences, have not only informed the national discussion over the last decade, but also formed key evidence for government consultations and influential select committee inquiries.

Since 2004, Professor Bochel and Dr Defty have undertaken wide-ranging investigations into the roles and attitudes of the country's legislators. With different strands of research examining parliament and welfare policy, and parliamentary scrutiny of the intelligence and security services, they are now recognised as leading authorities on constitutional reform, including the role

of parliamentarians in the House of Commons and the House of Lords.

The investigations by Professor Bochel and Dr Defty go straight to the heart of the current political landscape. For both strands of research, they have conducted interviews with large samples of MPs and peers, looking not only at the substantive topics, but also at their attitudes towards their own roles and influence.

By examining the role of parliament in the formulation and scrutiny of welfare policy, the research team found significant evidence to support claims for a new consensus on welfare, particularly in the House of Commons. They exposed a simultaneous lack of consensus within the House of Lords and revealed its implications for the future passage of policy legislation.

Their revelatory conclusions challenged existing arguments about the Second Chamber and provided groundbreaking new evidence to question the perceived expertise in the Upper House. This has raised questions around notions of representation in the House of Lords and the efficacy of some proposals for reform of the House.

Professor Bochel and Dr Defty submitted evidence to the Joint Committee on the Draft House of Lords Reform Bill and to the House of Lords Constitution Committee's inquiry into the process of constitutional reform. The team's findings were incorporated within both reports and were employed by the Electoral Reform Society to support its call for deepening expertise within the Second Chamber.

At a time when the scrutiny of intelligence is the subject of considerable debate and when previous research has focused

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Their revelatory conclusions challenged existing arguments about the Second Chamber, and provided groundbreaking new evidence to question the perceived expertise in the Upper House.

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almost exclusively on the work of the Intelligence and Security Committee, the team explored new ground when they set to work investigating other forms of parliamentary oversight. Their research into the alternative methods of scrutiny – from parliamentary questions and debates to the work of select committees and even all party groups – underpinned their submission of evidence to the government's consultation on the Security and Justice Green Paper. They also provided input to the government's consultation on parliamentary privilege.

Professor Bochel and Dr Defty's pioneering research has been featured across three separate episodes of BBC Radio 4's *The Westminster Hour*, widening understanding on the legislative, scrutinising and representative role of UK parliament amongst the public, academics and political representatives.

## Key Facts

**Legislators, Representatives and Experts: Influencing Parliamentary Reform**

**Research Centre/Group**

Policy Studies Research Centre

**Staff Involved**

Professor Hugh Bochel, Dr Andrew Defty, Dr Andrew Dunn and Jane Kirkpatrick

**Points of Interest**

The team's research in this area has received funding totalling more than £100,000 from the Leverhulme Trust and the Nuffield Foundation.

Professor Bochel and Dr Defty's work into expertise in the House of Lords has raised vital questions about the notion of representation in the Second Chamber, which has informed debates on parliamentary reform.



# Clarifying Powers of Entry

Professor Richard Stone



The rights of people whose premises are subject to searches by officials other than the police have been enhanced following research carried out by an academic from the University of Lincoln's Law School.

Professor Richard Stone's research into entry powers started in the 1980s. It has contributed to the recent reform of the law in the Protection of Freedoms Act 2012.

Professor Stone, who is the only UK academic specialising in this area, discovered that there was a lack of information and analysis of powers of entry to private premises available to officials other than the police.

Many central and local government departments have such powers, as do officials from companies running national utilities such as electricity, gas and water. Professor Stone aimed to identify and analyse these powers, and to provide a comprehensive survey of them. This is

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The result is a much clearer statutory framework of law governing the powers of entry of officials other than the police, and a Code of Practice applicable to all such powers.

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an ongoing process, since governments are continuously repealing or amending old powers or enacting new ones.

The research revealed, and continues to reveal, the lack of any coherent policy in relation to these powers. They are enacted in numerous ways, with differences in when they may be available and how they may be exercised.

The result is that individuals who are subject to these powers, and whose premises may have been entered, have great difficulty finding out whether the official claiming to exercise the power is acting lawfully or not.

In 2007, Professor Stone was contacted by a member of the House of Lords,

Lord Selsdon, who was interested in producing a private member's Bill to regulate these powers. He found that the 4th edition of Professor Stone's book, *The Law of Entry, Search and Seizure*, was the only source which provided relevant information.

Professor Stone's research highlights the need for the development of general principles applying to all entry and search powers used by those other than the police. It has led to his involvement in the drafting of the private member's Bill and its associated schedule of powers.

The Coalition Government picked up this reform in a Bill which became the Protection of Freedoms Act 2012. The result is a much clearer statutory

framework of law governing the powers of entry of officials other than the police, and a Code of Practice applicable to all such powers.

Professor Stone has been in discussion with the Home Office over the implementation of this law and its Code of Practice.

The principal output for the results of this research, *The Law of Entry, Search and Seizure*, was published in a revised and updated form in its 5th edition in 2013.

## Key Facts

### Reform of Law on Powers of Entry

#### Research Centre/Group

The International Law, European Law and Human Rights Research Network

#### Staff Involved

Professor Richard Stone

#### Points of Interest

There are currently around 1,400 separate powers of entry under primary and secondary legislation in the UK.

Professor Stone's research contributed to greater clarity and a stronger legal framework governing powers of entry through the Protection of Freedoms Act 2012.



# Research on the Governance of Doctors

Professor Judith Allsop

Recommendations from a Lincoln academic have informed government legislation to improve standards in medical practice.



Professor of Health Policy Judith Allsop undertook research for the government's Chief Medical Officer who had been tasked with recommending changes in UK medical governance.

The aim of the research was to investigate how other countries were ensuring that doctors kept up-to-date in their practice, how poorly performing doctors were identified and the action then taken to protect patients. The project was funded by a £30,000 grant from the Department of Health.

The study aimed to draw on countries with similar medical governance systems to the UK and those with different traditions and funding systems. Other requirements were to access data sources in English or to recruit an expert from the non-English-speaking countries to write a country report. Seven countries were selected for data collection –

Australia, Canada, Finland, France, the Netherlands, New Zealand and the USA.

The data was then analysed to identify trends in professional governance related to key questions, and to identify different models for keeping doctors up-to-date and dealing with poor performance.

Overall, the study found that most countries now put an emphasis on patient safety and regulatory agencies working in partnership with each other and with other stakeholders. In many countries, appointment by the state to governing bodies had replaced election from within the profession, alongside substantial lay membership. Most countries had begun to introduce periodic revalidation of doctors but were at different stages in the process.

Systems for identifying and tackling poor performance varied widely and were

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The resulting White Paper and legislation proposed a smaller, appointed GMC with equal lay and professional members, and annual relicensing and periodic revalidation of all doctors with recertification of specialist qualifications. It also recommended a tribunal chaired by a lawyer to adjudicate cases against health professionals.

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related to the type and structure of each health system. However, there was a trend towards separating the functions of investigation and remediation from cases that required adjudication where a doctor might be removed from practice.

The study findings recommended changes to the UK General Medical Council (GMC) to follow developments elsewhere. The aim of the GMC, in partnership with other stakeholders, should be to focus on protecting and promoting patient safety. There was a case for the appointment of a governing council and greater accountability and transparency.

A system for regular revalidation was recommended to ensure continuing competence. In addition, a peer-based system to assess a range of aspects of practice with professional and lay input was considered to have the best fit with the UK system.

The resulting White Paper and legislation proposed a smaller, appointed GMC with equal lay and professional members, and annual relicensing and periodic revalidation of all doctors with recertification of specialist qualifications. It also recommended a tribunal chaired by a lawyer to adjudicate cases against health professionals.

The research had an impact on the UK's reform process as it demonstrated that most countries in the study were reforming professional governance. It challenged the GMC's view of itself as a world leader in medical regulation at that time. The findings have been cited in numerous peer-reviewed publications and Professor Allsop has also advised on the reform of the medical profession in Italy.

## Key Facts

**Keeping Doctors Up-to-date, Identifying and Acting on Poor Performance: A Comparative Study**

### Research Centre/Group

The Policy Studies Research Centre

### Staff Involved

Professor Judith Allsop

### Points of Interest

The research was funded by a grant from the UK Department of Health.

Professor Allsop has acted as an advisor to government and parliamentary committees on complaints and professional regulation.



# Reforming Practice for Working with Offenders with Learning Disabilities

Professor Todd E Hogue

Research by the University of Lincoln's Forensic and Clinical Research Group has led to new risk assessment procedures for offenders who have a learning disability.



The Principal Investigator and grant holder on the study was Professor Todd E Hogue, at the time Lead Psychologist for The Peaks Dangerous and Severe Personality Disorder (DSPD) unit at Rampton Hospital, who moved to the University of Lincoln in 2006.

The study was initially commissioned to inform policy development around the management of individuals who might be considered to have a DSPD. The driving question was 'to what extent could measures of personality disorder and risk be validly used to understand and predict future violent or sexual offending with intellectually disabled populations?'

It was the largest systematic study of its kind to examine the applicability of risk and personality factors with offenders with a learning disability. In total, 12 measures of risk and personality were collated

from 212 patients across three levels of security, including ratings of violent or aggressive behaviour.

For a number of the measures, it was necessary to develop specialised training and recommendations, many of which now form the accepted professional practice for working with prison and secure populations. Guidelines developed by the Group on the psychological assessment tool used to rate psychopathy, the Psychopathy Checklist Revised, are now used as the standard professional guidance when using this measure with intellectually disabled offenders.

Patient behaviour was monitored for outbursts of violence over six months and the obtained measures used to predict the likelihood of violent behaviour and institutional progress. The central findings indicated that the personality

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The ultimate impact of the study is that there is a better understanding of how the risks presented by offenders with an intellectual disability are assessed, understood and managed.

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and risk measures could be validly used with a learning disabled population. This new clinical knowledge and the modified assessment techniques that followed benefit a range of professionals working with offenders who have an intellectual disability and are applicable across prison, health service and community settings.

The ultimate impact of the study is that there is a better understanding of how the risks presented by offenders with an intellectual disability are assessed, understood and managed. This has a significant impact for both offenders and the general public, by ensuring the more accurate prediction and management of the risk of future violence.

A number of the core assessments evaluated in the study are now used as part of the routine assessment procedure at the National High Secure Learning Disability Service at Rampton Hospital

and within Intellectual Disability Services at the Partnership in Care Group. The write-up of the project continues and the Forensic and Clinical Research Group is in the process of developing a ten-year follow-up of the sample.

The findings of the study have been used to inform professional training and international policy development in this area and a number of influential volumes have cited the work.

The research programme has significantly impacted on professional practice and has resulted in the development of new professional guidelines, including influencing forthcoming practice guidelines for the implementation of the fifth edition of the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders.

## Key Facts

**Offenders with Learning Disability: Changing Professional Practice Regarding Risk Assessment, Personality Disorder and Future Wellbeing**

### Research Centre/Group

Forensic and Clinical Research Group

### Staff Involved

Professor Todd E Hogue

### Points of Interest

Funding sources include a £112,000 research contract from the Home Office.

External partners include Professor Bill Lindsay of the University of Abertay, Dundee and Professor John Taylor of Northumberland, Tyne & Wear NHS Trust.

# Improving Road Safety for Children

Dr Karen Pfeffer

A psychologist from the University of Lincoln was appointed as a mentor with the World Health Organization after undertaking extensive research on child and adolescent road safety.



The World Health Organization appointed Dr Karen Pfeffer in 2007 to act as a mentor during the development of a road safety guide for children in Ghana. This followed on from her research and subsequent contribution to professional guidelines and training for parents, healthcare providers, educators and road safety officers around the world.

Globally, road traffic collisions are a significant cause of mortality and morbidity to children and young people, both as pedestrians and vehicle occupants. Dr Pfeffer's innovative research has significantly raised public awareness of everyday dangers and hazards.

Dr Pfeffer, a Senior Lecturer at the University of Lincoln's School of Psychology, received international recognition thanks to her investigations

into improving safety for vulnerable road users. Over the course of a decade, her work highlighted the need for new guidelines in road safety.

A combination of laboratory and field assessments was used to study key relationships between a child's attention, cognitive development and road-crossing decisions.

Dr Pfeffer worked closely with Dr Zahra Tabibi, now of the Ferdowsi University of Mashhad, Iran, on several elements of the project. Their research focused on children's attention capabilities and revealed that a combination of three key skills is essential when safely crossing a road. Selective attention, divided attention and the ability to resist distraction are crucial, particularly for younger children, when quickly and accurately selecting suitable road-crossing sites.

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International road safety training bodies have incorporated the findings about children's attention development when formulating professional guidelines and training.

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Dr Pfeffer showed that while adults acted as good role models for children, the research revealed a trend in adult behaviour, whereby a safer roadside approach was taken with girls than with boys. Her research with adolescents also showed that friends can directly influence safe and dangerous road-crossing decisions.

International road safety training bodies have incorporated the findings about children's attention development when formulating professional guidelines and training.

The US National Center for Safe Routes to School parent guide *Teaching Children to Walk Safely as they Grow and Develop*, the EBSCO Publishing Health Library *Teach Your Children to be Safe Pedestrians* parent guide and the US National Highway Traffic Safety Administration guide *Countermeasures*

*that Work* are just some of those currently incorporating Dr Pfeffer's findings.

The substantial international impact of Dr Pfeffer's research continued when she was invited to contribute to the World Health Organization's MENTOR-VIP symposium at the Safety 2010 World Conference. MENTOR-VIP is an international scheme that aims to develop an individual's skills and capacity in the area of violence and injury prevention by pairing them with an experienced mentor. Dr Pfeffer acted as a mentor in the programme in 2007/2008.

In addition, Dr Pfeffer's expertise led to her being commissioned to evaluate a regional road safety education programme for young drivers, the *2Fast 2Soon* campaign, which is run by the Lincolnshire Road Safety Partnership, as she continues to raise awareness of important road safety issues at home and abroad.

## Key Facts

**Beyond the Green Cross Code: Cognitive and Social Influences on Child and Adolescent Road Safety**

### Research Centre/Group

Evolution and Development Research Group

### Staff Involved

Dr Karen Pfeffer

### Points of Interest

Dr Zahra Tabibi of the Ferdowsi University of Mashhad, Iran, worked with Dr Pfeffer on the project.

Much of Dr Pfeffer's work focuses on cross-cultural psychology. Her work on the developmental aspects of road safety has had an international reach.



# Flourish or Fail? Examining Regional Economies

Liz Price, Dr Gary Bosworth and Dr David Gray

Research by economists from the University of Lincoln has helped to explain why some towns flourish as vibrant local economies with happy, healthy residents, while others fade to become ghost towns of failed businesses.



For almost a decade, the Enterprise Research and Development Unit at Lincoln Business School has sought to identify and understand the dynamics of the East Midlands regional economy.

The findings describe a complex web of characteristics and connections which shape the economic fortunes of our cities, towns and villages. They also point to policy interventions that could offer struggling settlements across Britain a lifeline to economic growth.

The research, which has been used to inform economic planning by local authorities across the East Midlands, has relevance for anyone with an interest in Britain's economic growth and has been backed by several large enterprises, including Yorkshire Forward, EMDA and the University's Schools of

Business and Law, with combined grants of £135,400.

The work, now being built upon by a new Rural and Regional Research Group, examines the relationship between businesses, people and geography. In economic terms, it looks at the spatial distribution of business activity and productivity. Transport infrastructure, new business start-ups, business turnover, unemployment, education and skills, and household income are all variables which together help to build a picture of how regional economies function. Two fundamental concepts in this approach are agglomeration and connectivity.

Agglomeration is about critical mass: at what point does a town reach the tipping point where the level of business activity and the strength of its labour market

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The research, which has been used to inform economic planning by local authorities across the East Midlands, has relevance for anyone with an interest in Britain's economic growth.

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become self-reinforcing? It is also about how 'sticky' a place is, in terms of attracting and retaining businesses and an active workforce.

Connectivity is about how different centres interact with each other and how links from place to place open up opportunities for trading, exchange, collaboration and innovation. In some places, major cities pull in economic activity, creating a wider hinterland of dependent settlements. In others, vital towns become nodes of innovation in wider connected networks of economic activity and exchange.

The findings, interpreted in the light of these two essential concepts, help to explain why poor transport links and traffic congestion stifle business growth, even in the most economically dynamic

towns and cities. They also make a strong case for creating conditions to support new business start-ups, particularly in struggling areas.

The research demonstrates how investment in stimulating enterprise can break the self-reinforcing cycle of low skills, low aspiration and low levels of business creation, which afflicts some of our most deprived communities.

The interdependencies between urban and rural places form the basis for further research with partners from the UK and the Netherlands, into the provision of broadband, the spread of home-based businesses and the impact of commuting upon small town and village communities.

## Key Facts

### Underpinning Economic Development Strategies in the East Midlands

#### Research Centre/Group

Enterprise Research and Development Unit, now the Rural and Regional Research Group

#### Staff Involved

Liz Price, Dr Gary Bosworth, Dr David Gray, Professor Andrew Atherton, Dr Andrew Johnston and Glyn Owen

#### Points of Interest

Funding sources include the University of Lincoln Research Excellence Fund, EMDA and Yorkshire Forward.

The research is being used by local authorities across the East Midlands to inform economic planning.



# Design for Sustainable Architecture and Environment

Professor Behzad Sodagar

A University of Lincoln sustainability expert is steering efforts by the construction industry to reduce the environmental impact of buildings through the creation of new design tools and award-winning sustainable architecture.



The roof of the Woodland Community Hall at Hill Holt Wood, constructed entirely from sustainable materials.

It is widely recognised within the construction industry that conventional approaches to planning and traditional procurement methods can exacerbate existing environmental problems, often leading to negative social and economic consequences.

Roughly half of all carbon emissions in the UK come from the use of buildings, and the construction process itself is one of the most energy-intensive of all manufacturing sectors. Reducing the environmental impact is a priority for government and industry. More emphasis is being placed by researchers and architects on identifying best practice and the most appropriate building systems for low-carbon construction.

Behzad Sodagar, Professor of Sustainable Architecture and Director of the Centre for Architectural Research at the University of Lincoln, is leading this

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The partnership resulted in an award-winning research and design programme and a building recognised as one of the finest examples of sustainable architecture within the UK.

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emerging field of sustainable design, researching autonomous eco-building systems and techniques for widespread implementation across the sector.

Professor Sodagar has almost 30 years research experience in this area. In 2005, Lincoln School of Architecture initiated a pioneering Knowledge Transfer Partnership (KTP) with Hill Holt Wood Social Enterprise, funded by the Department of Trade and Industry. The partnership resulted in an award-winning research and design programme and a building recognised as one of the finest examples of sustainable architecture within the UK.

Professor Sodagar's involvement with the social enterprise grew from an initial challenge set for his undergraduate students to design a fully fledged consortium built on a shared social vision. The Woodland Community Hall at Hill Holt Wood embraces low-energy

design principles and has received a string of national accolades, including a Lord Stafford Award for Innovation for Environmental Sustainability and a Green Apple for the Built Environment and Architectural Heritage Champion of Champions Award.

Throughout its construction, the team made the conscious decision to work alongside mainstream construction companies and local government bodies as part of a wider strategy to raise public awareness.

Professor Sodagar's ongoing research focuses on reducing the environmental impact of sustainable buildings, while ensuring they are not side-lined as a highly specialised subset of construction.

Professor Sodagar was one of the founders of the Construction Emissions Community of Practice, a voluntary and inclusive group of consultants

and academics working on developing the protocols for calculating and understanding the carbon footprint of buildings. The work of the group won a Royal Institute of British Architects award in 2008.

Alongside his colleagues, he is currently devising new methodologies and design tools to accurately predict the environmental performance of buildings. Crucially, these advances are enabling developers to calculate the carbon emission costs of buildings across their full life cycle, before the first brick has even been laid.

Professor Sodagar is also involved in various projects with housing providers and developers keen to enhance their own environmental performance.

## Key Facts

### Putting Research into Practice in the Design of Low Carbon Buildings

#### Research Centre/Group

Centre for Architectural Research / Sustainable Architecture Research Group

#### Staff Involved

Professor Behzad Sodagar and Professor John Chilton

#### Points of Interest

External partners include KTP Research and Sustainability Manager Bryce Gilroy Scott, KTP Industrial Supervisor at Hill Holt Wood Social Enterprise Nigel Lowthrop and Dr Rosi Feildson, Simons Design (Simons Group).

The project received more than £350,000 in grants and awards from the Department of Trade and Industry, Waste Resources Environmental Management and Lincolnshire Enterprise.



# Uncovering the Past

Ian Crick-Smith and Michael Crick-Smith

A team of specialists from the University of Lincoln's renowned conservation consultancy division, Crick Smith, is safeguarding the significant historic interiors of important national landmarks thanks to highly specialised preservation techniques.



The original stencilled ceiling at St Pancras Chambers, now the St Pancras Renaissance Hotel.

Architectural paint research is a key but relatively new research tool that allows the decorative history and archaeological development of a building to be discovered.

A pioneering new methodology established by a team of experienced conservators at Crick Smith combines archival research with microscopic examination of paint samples, to clarify the decorative history of a room, a building or its exterior. Founded by Senior Researchers Ian and Michael Crick-Smith, the consultancy uses this technique to uncover the historical truth behind previously concealed interiors, with a portfolio ranging from industrial buildings to royal palaces.

Their findings are crucial to the detective work that informs interpretation of the complex history of a building and play an important role in establishing how it

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should be interpreted and presented to the public.

Crick Smith has in recent years been enlisted by the National Trust, Historic Scotland and the World Monuments Fund Britain. Their authoritative consultancy has, since 1995, formed the basis of English Heritage's decision-making process when renovating and reinstating the historic schemes of Kenwood House, London.

Thanks to the team's pioneering research into the Cast Courts at London's Victoria and Albert Museum, the two vast galleries of historic plaster cast and electrotype reproductions will soon be reopened to the public. The 19th Century creations by Major General Scott were previously untouched; yet research by Crick Smith successfully defined the exact locations, applications and treatments of colour, providing a comprehensive new understanding of the works and their place in history.

In 2011, Crick Smith conducted architectural paint research at the Church of St James the Less in Derbyshire. Their innovative analysis concluded that a decorative scheme from c.1880 was concealed under layers of modern decoration. Crick Smith was commissioned to reveal and reinstate the original scheme and, as a result of these developments, the church is now a successful heritage centre, generating increased visitor numbers and income, and encouraging public reflection on a renewed historic environment.

Enhancing general understanding of conservation practice through the execution of work in public view has been another strategic goal of the team.

Crick Smith has researched, developed and produced a historic palette of colours that defines the domestic paints used throughout England during the 1960s,

'70s and '80s for English Heritage and The Little Greene Paint Company. Following extensive research, which included identifying cultural and social trends of the period, the 'Retrospectives' range was launched at Decorex International in September 2011.

Crick Smith is based in the University of Lincoln's School of Art & Design. Their projects have informed national conservation and reinstatement programmes for more than 25 years and they have now been commissioned by HRH Prince Charles to undertake extensive research of interiors and artefacts at Dumfries House, Ayrshire. Crick Smith also manage and curate the English Heritage Archive of Historic Interiors Research.

## Key Facts

### Architectural Paint Research and the Interpretation of Historic Interiors

#### Research Centre/Group

Centre for Conservation and Cultural Heritage

#### Staff Involved

Ian Crick-Smith, Michael Crick-Smith, Paul Croft, Dr Rachel Faulding, Henning Schulze, Dr Lynda Skipper, Dr Jim Cheshire and Sarah Cheng

#### Points of Interest

External partners include the National Trust, English Heritage, Historic Scotland, Cadw, the World Monuments Fund, the Ministry of Defence, Chanel, BAE Systems and the Victoria and Albert Museum.



# Comics and the World Wars

Professor Jane Chapman

A major body of research from an historical communications expert at the University of Lincoln has re-categorised comic books and strips as significant cultural artefacts.

AND TIGHTENS AROUND HIS WAIST WITH THE UNFAILING GRIP OF A BOA CONSTRICTOR! THE SHOCK IS GREAT BUT HER LOVE AND STRENGTH ARE GREATER!



Professor Jane Chapman's pioneering research demonstrates the potential of comics to reveal uncensored information about societies' attitudes, emotions and propaganda at significant points in history. Her studies encourage a better understanding of the major cultural impact of comics produced during and about the two world wars. Her project, entitled *Comics and the World Wars – A Cultural Record*, is funded by a £538,500 grant from the Arts & Humanities Research Council (AHRC) and explores forgotten publications worldwide.

It is common for the reading public to harbour nostalgic memories of childhood publications, without realising that they reveal significant cultural insights of great relevance to social historians.

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Far from being an ephemeral art form, comics tell us about epic historical events, public consciousness, emotions, trauma, contemporary political satire and our own cultural heritage.

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They highlight, for instance, the gendered and class aspects of world war history that often remain unacknowledged.

Professor Chapman, who commenced her investigation in 2009, now leads a team of four other expert researchers. Their extensive research demonstrates that far from being an ephemeral art form, comics tell us about epic historical events, public consciousness, emotions, trauma, contemporary political satire and our own cultural heritage.

In the run-up to the centenary of the First World War (1914-18) and the 70th anniversary of the end of the Second World War (1939-45), this research will culminate in two major exhibitions at London's Cartoon Museum. It explores wide-ranging publications from across

the UK, Europe, Australasia, Japan and the USA, examining different countries' attitudes to war.

The groundbreaking investigation places particular emphasis on publications from the First World War that contributed to the origins of the comic format.

Professor Chapman examines how ordinary soldiers drew comic strips in their own amateur trench newspapers, discovering hundreds of poignant examples that address the everyday concerns of lower-ranking servicemen. Her fascinating research prompted the BBC to select her as an elite consultant for their 2014 anniversary programming on the First World War.

Professor Chapman explained the representation of gender in her findings on Australia's *Wanda the War Girl* and the *Daily Mirror's* famous *Jane at War* during a dedicated BBC Radio 4 *Woman's Hour* talk.

Furthermore, two PhD students on the research team secured additional AHRC funding to search for previously unseen archive material at the world's largest library, the Library of Congress in Washington, DC, making it the most extensive and instructive study of its kind to date.

## Key Facts

### Comics and the World Wars – A Cultural Record

#### Research Centre/Group

Comics Research Group

#### Staff Involved

Professor Jane Chapman, Anna Hoyles, Dan Ellin, Andrew Kerr and Adam Sherif

#### Points of Interest

External partners include Dr Kent Worcester of Manhattan Marymount College, New York and The Cartoon Museum, London.

This research has redefined the way that comic strips are viewed as a source of archival information by historians and other academics.



# Tennyson Transformed

Dr Jim Cheshire

A pioneering study by a cultural history expert from the University of Lincoln has uncovered the real extent of Alfred Lord Tennyson's centrality to Victorian visual culture.



Alfred Lord Tennyson held the esteemed post of Poet Laureate for more than 40 years and for much of Queen Victoria's reign. He inspired a deep commitment from Pre-Raphaelite artists and his career was intricately linked to the development of photography throughout the Victorian era.

Tennyson's poetry habitually emerged as the popular subject of visual arts throughout the 19th Century, and innovative research by Dr Jim Cheshire now reveals the magnitude of his work's non-literary influence.

Dr Cheshire, a Reader in Cultural History at the Lincoln School of Art & Design, has been researching Victorian culture for more than 20 years. While recent strands of Tennyson scholarship highlight the influence of visual and material culture in understanding the words of the poet, Dr Cheshire's novel

and far-reaching exploration visits uncharted academic territory.

He exposes the ways in which visual artists used Tennyson's work as a vehicle to express contemporary anxieties and beliefs. In 2009, his comprehensive discoveries were showcased through his study and an exhibition, *Tennyson Transformed*.

Demonstrating just how varied the relationship between a poem and its visual manifestation can be, *Tennyson Transformed* revolutionised the way in which the poet's work is interpreted in relation to visual art.

For the first time, Tennyson is exposed not just as a poet, but as a figure through which we can glimpse a complex series of relationships between literature, art, commerce and popular culture. Dr Cheshire and his team pioneered

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For the first time, Tennyson is exposed not just as a poet, but as a figure through which we can glimpse a complex series of relationships between literature, art, commerce and popular culture.

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a new school of thought, confirming that the deliberate juxtaposition of the visual arts alongside Tennyson's work did not merely evoke the past, but also stimulated creative practitioners to develop and exploit new technologies.

Tennyson is now recognised as a timely and fundamental influence on the development of the visual arts.

The pioneering exhibition coincided with the international Tennyson Society Conference, *The Young Tennyson*, where Dr Cheshire presented his findings to an audience of delegates from across the globe.

Supported by a comprehensive catalogue, critical essays, peer-reviewed articles and a number of other publications, *Tennyson Transformed* formed the basis of a successful Heritage Lottery Fund grant application. The award of £50,000 effectively increased awareness of

Lincolnshire's Tennyson Research Centre, while funding the essential conservation of historically significant photography and literary illustrations.

Developing public understanding and ensuring the accessibility of Tennyson's poetry were also primary concerns for Dr Cheshire. To this end, the grant supported the formation of valuable education programmes and enabled the exhibition's curators to present their remarkable findings within a national context. To date, almost 30,000 members of the public have experienced the pioneering display, which was named 'Best Exhibition' at the Renaissance East Midlands Heritage Awards.

Dr Cheshire is now working on *Tennyson and Mid Victorian Publishing*, a monograph to be published by Palgrave Macmillan in 2015.

## Key Facts

### Tennyson Transformed – Alfred Lord Tennyson and Visual Culture

#### Research Centre/Group

Centre for Conservation and Cultural Heritage / 19th Century Research Group

#### Staff Involved

Dr Jim Cheshire

#### Points of Interest

External Partners include Grace Timmins, the Tennyson Research Centre; Andrea Martin, Lincolnshire County Council; and The Collection, Lincoln.

Dr Jim Cheshire extends his interdisciplinary links with research through his role as Historical Consultant at the University's conservation consultancy, Crick Smith.



# Televising History

Professor Ann Gray and Dr Erin Bell

Two experts from the University of Lincoln have conducted an extensive study into televised history programmes, shining a spotlight on the sections of society that are being excluded from our screens.



For mainstream television viewers in the UK and throughout the world, non-fiction history programmes have become increasingly popular as interest in personal, local and national heritage continues to grow. Television has emerged as an important vehicle for the dissemination of history to new, wide and diverse audiences.

Yet a pioneering body of research highlights the notable absence of females, people of ethnic origin and minority groups in televised history programmes.

The interdisciplinary investigation was undertaken by Ann Gray, Professor of Cultural Studies at the Lincoln School of Media, and Dr Erin Bell, a Senior Lecturer in History at the Lincoln School of Humanities.

Together they conducted four years of extensive research funded by a £234,064 grant from the Arts & Humanities Research Council. They combined historical and television scholarship to reveal how recent changes in the media landscape have affected the way in which history in general, and whose history in particular, appears on television in the UK.

Throughout their research, Professor Gray and Dr Bell engaged with the work of renowned historians and influential media professionals in order to identify the complex processes behind the production and mediation of history on television.

They defined the significance of selected images, editing techniques and presentation styles, which highlight a number of regular omissions that are made throughout history programming on television.

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The resulting overview of UK history programming formed part of the influential Italian-based *A TV History for Europe* project and was presented to the European Parliament in December 2011.

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Their findings reveal that the involvement of females and ethnic minorities in a country's history is not necessarily included in its on-screen documentation.

Professor Gray and Dr Bell question this representation of the historical British identity, raise awareness of predispositions to assume that television audiences are male-dominated and reveal that female presenters can be few in number and are subject to increased criticism of style and appearance in comparison to their male counterparts. However, they noted that programmes aimed at a broader audience such as *Who Do You Think You Are?* were more likely to include diverse histories.

Their resulting overview of UK history programming formed part of the influential Italian-based *A TV History*

*for Europe* project and was presented to the European Parliament in December 2011. Their internationally significant findings are summarised in numerous journals as well as in their book, *History on Television*, which was published by Routledge in 2013.

Professor Gray was invited to present the key research findings to television production teams, while appearances at important postgraduate conferences, symposia for media professionals and international conferences for historical scholars have seen the interdisciplinary findings disseminated to key academics, historians and media professionals throughout the television industry.

## Key Facts

### Televising History 1995-2010

#### Research Centre/Group

21st Century Research Group

#### Staff Involved

Professor Ann Gray and Dr Erin Bell

#### Points of Interest

Findings from this research were published by Routledge in the researchers' book *History on Television* (2013).

The project culminated in the *Televising History* conference, attracting scholars and industry practitioners from across the globe to Lincoln.

The team continues to conduct interviews with historians and advise media professionals in the UK and in Europe.



# First President of the ANC

Professor Heather Hughes

Research that led to a publication on John Dube, founding president of the African National Congress (ANC) has had a significant impact on government, national media and public history and debate in South Africa.

Professor of South African Studies Heather Hughes' research on the eminent politician culminated in the first full-length biography on Dube, *First President*.

The work, which required research across three continents and five languages, has changed attitudes towards Dube as a political leader and towards the role of women in African nationalism in the early 20th Century.

Leading statesmen such as Dube would, in a less discriminatory society, have been well represented in archives.

However, because of the deprivation and denial resulting from segregation and apartheid, no important collections of personal papers of any leading African nationalist figures of this first generation have survived.

Professor Hughes hunted down many fragments from archival collections and took oral histories from Dube's former colleagues, friends and acquaintances.

This research has enabled Professor Hughes to revise the standard account of Dube as the man who individually brought about transformative social and political change, by recovering the suppressed narrative of women's roles in South African nationalism.

Professor Hughes was able to show that many achievements previously attributed to Dube should either be credited to his first wife, Nokutela, or to both of them as a team, such as the founding of the independent school, Ohlange.

*First President* has featured in the South African press, with many media outlets highlighting the role of Dube's first wife in the growth of the ANC.



The statue of John Dube at the Ohlange Institute, South Africa. Inset: Nokutela, Dube's first wife.

“

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”

Professor Hughes was invited to select extracts of her work for a double-page spread in *City Press*, South Africa's premier 'black' newspaper for the day of the ANC centenary. She was also interviewed on national television and radio.

Her work has featured on the blog posts of high-profile figure Zachie Achmat, a leading global campaigner for AIDS treatment, who called *First President* his book of the year.

Professor Hughes' research has informed the South African government's work on land reform and challenged public perceptions of the early history of the ANC. It was quoted extensively in the Government Green Paper (2011) on land reform, which addresses one of the most pressing legacies of apartheid, to strengthen arguments for radical change in land tenure by demonstrating the

parallels between land distribution a century ago and in the present day.

As a result of this paper, national reference groups on land reform were set up, working towards the establishment of a land rights management board.

Professor Hughes' expert knowledge on the life and legacy of the Dubes resulted in her being awarded a contract to produce the content for a heritage exhibition at Dube Trade Port, the largest international air logistics hub in the subcontinent of Southern Africa.

The task entailed writing interpretive text on Dube and other historically prominent figures associated with the area. She included material on the achievements of Nokutela Dube for the first time in a public exhibition.

## Key Facts

**Biography of John Langalibalele Dube, Founding President of the African National Congress**

### Research Centre/Group

Rural and Regional Research Group

### Staff Involved

Professor Heather Hughes

### Points of Interest

*First President* is the first full-length biography of this historically significant figure.

The book has influenced land reform in South Africa.

Professor Hughes' research spans African studies, heritage and tourism.



# Research Resources

From new buildings and high-specification equipment through to investment in unique archives and healthcare facilities, the University of Lincoln invests in the latest resources to facilitate research-informed study.

The following pages list a selection of the cutting-edge facilities across the University's three Colleges, many of which are available to external partners. To enquire how you or your business could access our state-of-the-art resources and academic expertise, please use the contact details on page 57.

## College of Science

- A multi-million pound **Science and Innovation Park**, established in collaboration with Lincolnshire Co-operative, provides **laboratories for pharmaceutical and biological sciences** as well as spaces for other scientific, industrial and engineering development enterprises
- The **Science Centre**, which houses an **analytical chemistry laboratory** with state-of-the-art apparatus for the analysis of solid, liquid and gas samples and cutting-edge equipment for research into improving forensic science techniques
- Facilities for research in the **biological sciences**, including equipment for the growth of mammalian and human cell cultures, instruments for DNA, RNA and protein analysis, and a category 2 microbiology laboratory for the safe handling, growth and study of micro-organisms at category 1 or 2 level
- Specialist **laboratories for the study of animal behaviour, cognition and welfare**, including a cold-blooded vertebrates cognition laboratory, invertebrates collection, companion animal behaviour centre and a dog training centre
- An **imaging suite** includes a number of high-specification microscopes used for high resolution and 3D analysis, probe analysis of the surface of specimens and nanoparticle analysis, useful for research in both engineering and life sciences
- The purpose-built **Engineering Hub**, with specialist laboratories, including a **laser laboratory**, which facilitates research within a wide range of wavelength spectra and power levels, a fully equipped **metrology laboratory**, which houses equipment for the study and manipulation of surfaces, and a **bespoke research rig** for the testing of high-speed rotating machinery
- Siemens have co-located **global product training facilities** and equipment in the Engineering Hub, including large-scale atmospheric chambers for advanced combustion research
- High-end technical **resources for computer science**, including **full design software platforms** for the design and simulation of custom CMOS integrated circuits and programmable logic; together with universal **test facilities for imaging devices**
- A well-appointed **robotics laboratory** with a number of state-of-the-art platforms, including Metralabs Scitos-G5 mobile robot, Pioneer 3-AT mobile robot, AirRobot AR100B aerial robot, Philips iCat interaction robot and a large number of other platforms for research projects
- The **National Centre for Food Manufacturing** is fitted with the latest food manufacturing equipment, including automated fresh food weighing and packaging lines with robotic case packing, a sensory evaluation suite, product development kitchen, microbiology and food chemistry analytical laboratories, and a library, with access to specialist food collections and databases
- A **240-hectare arable farm** and **180-hectare mixed farm estate** facilitate research into agriculture, animal welfare, ecology and plant biology.





## Research Resources

### College of Arts

- The industry-standard **Media Broadcast Production Centre**, which includes television studios containing HD cameras, radio studios, video and audio editing suites, digital imaging suites, a 24-track live HD digital multitrack audio studio, a photography studio, multimedia suites and the Lincoln Sound Theatre
- The **Media Archive for Central England (MACE)**, containing more than 70,000 regional videos and films
- The **John Pilger Archive**, housing a definitive, scholarly collection of the work of the internationally acclaimed journalist
- The **National Decorative Interiors Collection** archive
- Close relationships with the **Lincoln Cathedral Library, Lincolnshire**
- **Archives** and the **Tennyson Research Centre**, providing access to key primary source material
- The **Lincoln Performing Arts Centre**, containing a 446-seat theatre and four multi-purpose studios, including a 75-seat black box space
- **Architecture, Art and Design workshops** with rapid-prototyping machinery, colour 3D-printing, 3D-scanning, laser-cutting and CAD equipment
- A **public gallery** for the exhibition of work by students and practising artists
- **Specialist conservation and restoration laboratories** and research spaces for the examination of the deterioration of fabric of historical buildings and monuments, and conservation of historic collections.

### College of Social Science

- The **Psychology laboratory suite**, housing state-of-the-art equipment for research in numerous areas of psychology, including psychophysiology, the cognitive neuroscience of sleep, language lateralisation and child development
- The University of Lincoln's **Barbary Macaque field site** in Morocco has specialist equipment for the study of behaviour and cognition in primates
- A fully equipped **clinical suite with separate treatment, teaching and observation areas**, designed to resemble different clinical settings, such as ward and community settings, for research around nurse practice and pedagogy
- The **Human Performance Centre**, a cutting-edge facility comprising specialist laboratories for sport and exercise science. Specialist equipment includes an Endless Pool, isokinetic chair, curve treadmill and cycle ergometer
- Portable equipment is available for **field research in sport**, including measuring expired gases, team physiological monitoring, force platforms, pressure plate, real-time motion capture and electromyography
- A specialist **Law Library**, which provides access to specific law-related databases, such as Westlaw, LexisNexis, HeinOnline and Lawtel
- The **Research, Enterprise and Innovation Centre** and the **Lincoln Leadership and Management Centre** act as a gateway to the business world.



# Early Career Researchers

The University of Lincoln provides a highly supportive platform for the development of Early Career Researchers (ECRs) where they can share knowledge and expertise and gain vital experience of engagement across the disciplines.

**W**e ensure that new academics, and those making the transition from postdoctoral research, receive the guidance and support they need to establish themselves as independent and confident researchers.

The University of Lincoln is committed to the Vitae Concordat regarding the development of academic careers and ensures that there is consistency of approach and support for researchers across our three Colleges. To this end, we provide assistance to College Research Centres and teams on the establishment of their own local practices for the support of, and investment in, ECRs, which is underpinned by their own tailored personal and professional development programmes.

We have launched an ECR forum where dialogue, discussion and debate is evidenced. There is information on funding, bid writing and gaining peer-to-peer mentoring and support.

At Lincoln, we have placed ECRs at the centre of our Research Plan, in recognition of the vital contribution they make to enriching the diversity of our research environment and ensuring our continued growth in innovative and cutting-edge research.

## Dr Louisa Parks

Lecturer in the School of Social & Political Sciences



“My research looks at how, and if, civil society can change European legislation through transnational activism. This is an update of

my original doctoral thesis and helps bridge the gap between studies of representation and social movements.

“The University has given me a huge amount of support. I have received funding to carry out further research and had the opportunity to attend international conferences. In particular, my mentor has been a great source of support and advice, giving me tips on teaching and guidance on drafting a book proposal.

“The University of Lincoln invests in promise. It’s somewhere you can breathe and grow.”

## Dr Oscar Martinez-Mozos

Lecturer in the School of Computer Science



“My current studies focus on two lines of research. One explores the theoretical aspects of how robotics can understand the world through

processes of detection and recognition. The other explores the use of quality-of-life technologies and artificial intelligence to enhance the lives of those suffering from disabilities.

“After finishing a post-doctoral Fellowship in Japan, I was looking for my next academic venture and contacted the University of Lincoln.

“At Lincoln, there were academics who were familiar with my research and I was encouraged to accept a role as an Early Career Researcher. The robotics research here is highly innovative and the University itself is incredibly proactive in creating a supportive research environment.”

## Dr Agnes Woolley

Lecturer in the Lincoln School of Humanities

“My main area of interest is in postcolonial literature and culture, specifically in representations of migration and asylum in contemporary fiction and film. I have a book forthcoming in 2014. After completing my PhD, I was offered the post of Early Career Researcher at the University of Lincoln.

“Since joining the University, I have received much support in my research. The library is a fantastic resource and I feel energised by the atmosphere here. As an Early Career Researcher, I am able to focus on developing my next research project, which explores the exciting intersections between postcolonial and ecocritical studies.”







## Kevin Mahon

PhD student in the School of Life Sciences

“I am currently halfway through my PhD research in which I am exploring the nature of wandering cats and cat management in the UK; paying close attention to electronic containment fences for cats and assessing their potential welfare implications.

“Through my work with the School of Life Sciences, I had the chance to appear on a BBC documentary in which the team and I were filmed exploring the hidden life of the domestic cat. This provided a great opportunity to disseminate our research to the broader public and the programme was well received by a national audience.

“I came to Lincoln as I was interested in joining a university that is making incredible gains. The University puts in a lot of effort to provide tailored support for its postgraduate students.”

# Our Postgraduate Research Community

The University of Lincoln recognises that its research students are critical to providing a dynamic and healthy research environment.

The institution has been successful in attracting a diverse range of external funding opportunities for our students, from Research Councils UK Block Grant Awards and Collaborative Doctoral Awards, through to European Commission and industrially sponsored programmes in partnership with leading businesses.

The University of Lincoln’s Graduate School provides a highly collegiate setting where our postgraduates can enjoy support for their research studies, as well as acclimatise and integrate into academic life. In addition to practical support, our Graduate School helps students access competitive funds made available by the University for research studentships and projects.

The School holds an annual postgraduate conference where academics and research students showcase their work and debate key challenges of current interest to academic, business and wider communities.

## Claire Markham

PhD student in the School of Social & Political Sciences



“For my PhD research I have been investigating the decline of village pubs in relation to the impact that this has on rural

communities. This is an interesting and interdisciplinary subject area as not only does it focus on the social side of rural communities; it also explores the historical and business aspects of rural pubs.

“Although my area of study has never really been explored before, this has never been an issue. My supervisor has been extremely supportive and helps me with any and all questions that I have whilst conducting my research.

“The Graduate School is brilliant and the University provides funding for me to go to conferences to disseminate my research to a wider field.”

## Phil Begley

PhD student in the Lincoln School of Humanities



“I have just completed my PhD thesis, which explores the history of the Conservative Party when they were in opposition between

the years of 1974-1979; examining the development of party policy in relation to a number of key themes that were important at that time.

“The University has supported me greatly during my studies by providing me with mentors that are well suited to my original thesis proposal, and who are well respected and accomplished in their fields.

“In addition, I received a grant from the University through the PhD studentship scheme, which funded my research. Without this support, I would not have been able to continue my studies and complete my PhD.”



# Work with us

At the University of Lincoln, our academics and research students can work with you to change your world for the better.

If you or your business are looking to devise an innovative solution to a challenge you are facing, explore a line of inquiry or develop your staff, we can help. A range of bespoke options are available, giving you access to tailored support from our internationally renowned experts and state-of-the-art facilities.

## Bespoke Research

Our academics work with industry partners on both blue sky and applied research, delivering innovation and sustainable solutions to current and potential future issues. If you would like research conducted to uncover or resolve a specific challenge, to answer questions relevant to your industry or sector, or to develop an idea, product or service, contact us to discuss your requirements and options.

## Consultancy and Collaborations

Our academics and researchers work alongside a wide range of organisations, from small and medium-sized businesses through to governments and large multinationals, in both consultancy and partnership roles. In addition, the University can work in partnership

with you through grant and funding application processes, the forming of collaborative consortia, networks and research centres, and in establishing and exploiting intellectual property.

## Professional Development and Research Degrees

The workforce is the lifeblood of an organisation. To help you ensure that your staff have the latest knowledge and skills to drive your business forward, the University of Lincoln offers a wide array of courses to suit your training requirements. Options range from short Continuing Professional Development courses to traditional undergraduate and postgraduate degrees, many of which are available part-time or through distance learning.

For distinct training needs, our experts can develop bespoke programmes specifically for your business.

A postgraduate research degree may be an option if you have a specific area of inquiry that you or a member of staff would like to explore. Students are assigned academics with relevant expertise, who will provide guidance and agree a structured framework in which the research can be completed.

## State-of-the-art Facilities

Continual investment in the University's estate and resources ensures that academics, researchers and students have access to the latest industry standard equipment and space. Facilities are often available for the research and development needs of our external partners and research collaborators. More information on our resources can be found on pages 48-51.

## Knowledge Transfer Partnerships

Knowledge Transfer Partnerships are a government initiative that link companies with a university and a recent graduate to complete a specific project. The business benefits from the skills and expertise of the graduate and their academic mentors as well as access to university resources, while the graduate gains valuable experience and an insight into their chosen industry sector.

## Research Contacts

To discuss research collaborations, consultancy and training requirements, please contact our Research and Enterprise Services Team. They will put you in touch with the relevant person or team to further consider your ideas and needs.

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