



KEELE  
UNIVERSITY

# keele:knowledgeforlife

RESEARCH AT KEELE UNIVERSITY



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“ We are proud of our achievements in high quality multidisciplinary research and in the application of research knowledge to beneficial outcomes ”

# Promoting world-class research

Keele is a university which places high value on excellent research and we support internationally competitive expertise throughout the Natural Sciences, Social Sciences, Health and Humanities. We have established seven Research Institutes to provide this support and an environment for growth. We aim to provide an environment where high quality research can flourish, where we can encourage multidisciplinary work and support researchers to share their expertise to the benefit of the UK economy and the nation's quality of life.

The Institutes will enable the University to focus resources and effort on areas of research strength, to foster the profile of those research activities where Keele reaches standards of international excellence. They now manage all funds for research which the University receives, and have staff dedicated to supporting research and associated enterprise activities. All staff who are active in research are members of an Institute.

To determine the focus for each Institute, the University identified seven multidisciplinary themes which represent areas of strength for Keele and include staff from a wide range of disciplines. They are:

- **The Institute for Primary Care and Health Sciences**
- **The Institute for Science and Technology in Medicine**
- **The Institute for the Environment, Physical Sciences and Applied Mathematics**
- **The Institute for Public Policy and Management**
- **The Institute for Life Course Studies**
- **The Institute for Law, Politics and Justice**
- **The Institute for Humanities**

We are proud of our achievements in high quality multidisciplinary research and in the application of research knowledge to beneficial outcomes. The establishment of Research Institutes will help to develop these strengths further. The development of solid fuel technology is one example of current research which illustrates our multidisciplinary approach and its application to real-life issues. Our Institute for the Environment, Physical Sciences and Applied Mathematics is developing the use of vegetable oils for direct industrial applications with significant support both from the Research Councils and from industry.

Another example is Keele's pioneering studies into the social aspects of ageing with substantial Research

Council and charitable funding support. As a result of recent research into ageing and social inclusion, Keele researchers in the Institute for Life Course Studies are providing high level advice to the Department for Communities and Local Government.

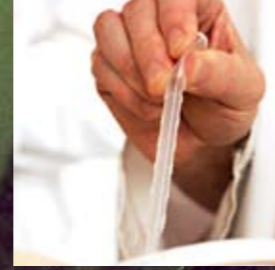
Keele's multidisciplinary work on ageing also draws in research from a range of Social Science, Medical and Health disciplines. It links with another of our strong multidisciplinary teams, the Institute for Primary Care and Health Sciences who work on the management of painful conditions, particularly musculoskeletal conditions, in primary care settings. This involves internationally competitive research, supported by Research Councils and major charities, but is also closely linked to research networks of GPs and other Health professionals who are supporting the translation of findings into clinical practice.

These are only three examples of Keele's approach to building and sustaining high quality research and associated knowledge transfer. This publication gives an overview of some of the exciting work taking place at Keele within the Research Institutes. It provides an insight into the wide-ranging research projects across the University.

*Janet Finch*

**Professor Janet Finch, CBE, DL, AcSS  
Vice-Chancellor**

## Turning the Table on Human Disease



Professors Paul Eggleston and Hilary Hurd



## Malaria, Mosquitoes and Man – Breaking a Deadly Cycle

Malaria kills a child every thirty seconds in Sub-Saharan Africa. It is a huge problem threatening over 40% of the world's population and still on the increase. The infection causes more than 300 million acute illnesses and at least a million deaths annually, and is recognised as a major factor impeding the development of some of the poorest nations.

Past strategies to kill off mosquitoes with insecticides failed as they developed resistance, just as malaria itself has developed resistance to some of the drugs used to control the disease. Researchers at the Institute for Science and Technology in Medicine are focusing their efforts on trying to break the transmission cycle through which the disease is passed on, by studying the complex relationship between the parasite and the mosquito itself.

Hilary Hurd, Professor of Parasitology, said: "One of the surprising things is that it takes so long for the malaria parasite to develop in the mosquito. It takes around 15 days and the mosquito in the wild often only lives that long. So it's very much on a tightrope that the parasite is walking, it must keep its mosquito alive long enough for it to survive to transmit the infection into the next person. So that time period is the key aspect of the life cycle."

Another area of weakness they have discovered in this complex parasitic relationship is that the infected female mosquito produces fewer eggs. The likelihood is that this is a resource management strategy so the mosquito lives longer allowing the parasite to mature to an infective stage. If the mosquito was made to lay more eggs, it would die too early for the parasite to mature, again breaking the transmission cycle.

Professor Hilary Hurd: "If we can understand more about the biology and particularly the molecules involved that are critical to maintaining the cycle, then we can try to interfere with those molecules, perhaps by manipulating the mosquito genetically so that a key molecule is produced in more abundance or is not produced at all and upset this delicate balance between infection and survival."

**"We now have mosquitoes which are resistant to every class of insecticidal compound that we can throw at them"**

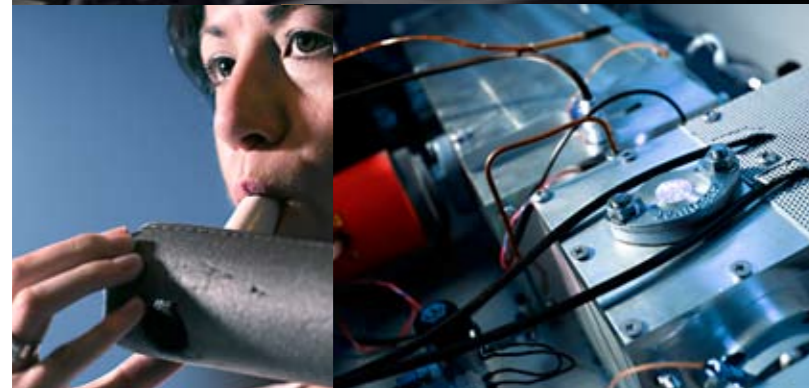
Paul Eggleston, Professor of Molecular Entomology, said: "We have growing problems with insecticide resistance – we now have mosquitoes which are resistant to every class of insecticidal compound that we can throw at them. We are starting to think about the complex set of interactions that take place between the mosquito and the parasite and whether there are ways within that set of interactions that we can tackle the transmission cycle itself."

One discovery of particular interest is that many of the parasites contained in the blood cells a mosquito absorbs during a blood meal, are killed off within the mosquito's gut within the first twenty-four hours.

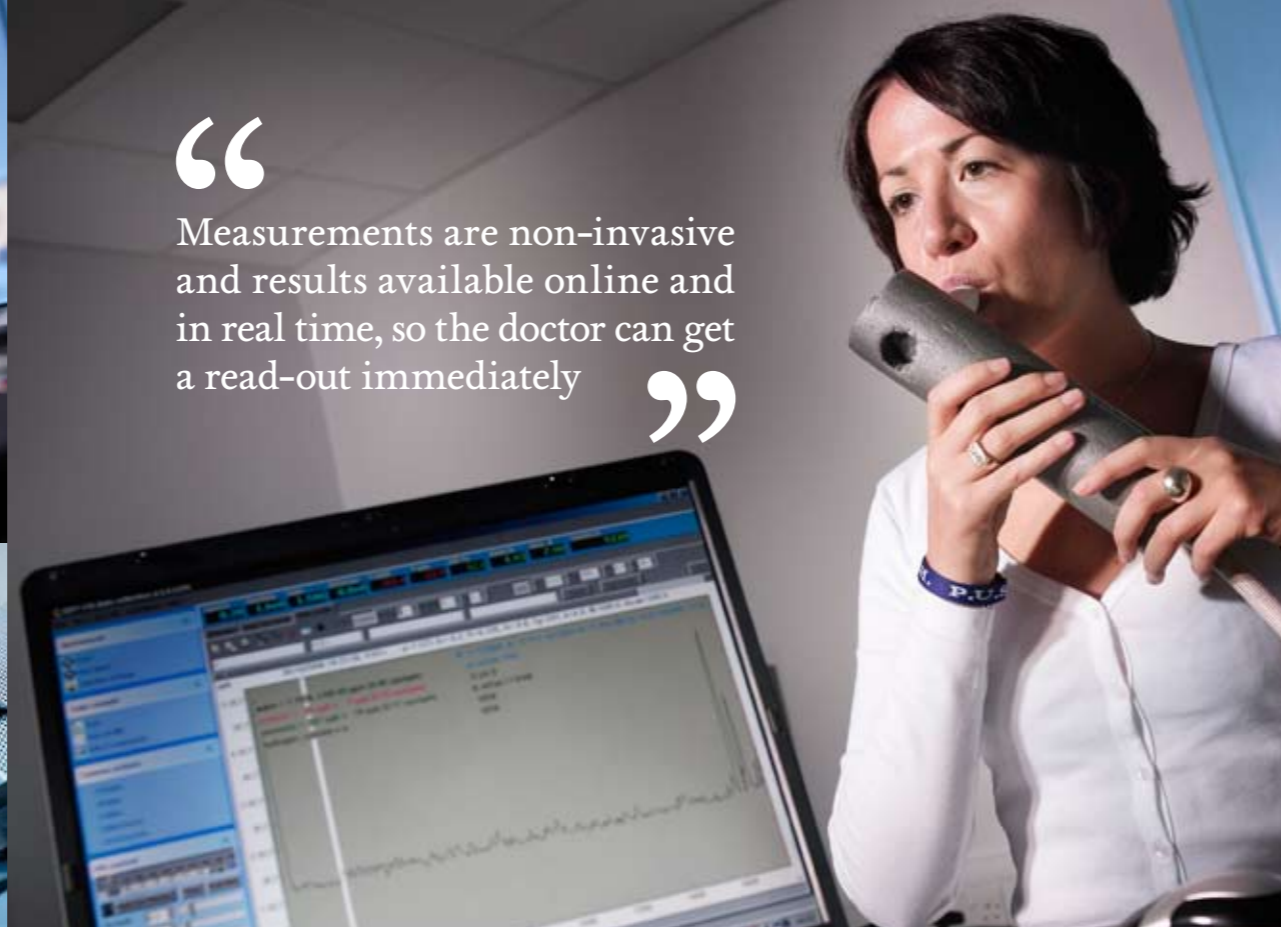
The researchers think one method by which this is done is by 'programmed cell death', so they are investigating how this is triggered, and whether that action could be enhanced.

The aim is to engineer a mosquito which is simply incapable of transmitting malaria. The ultimate vision is to replace natural populations of malaria-carrying mosquitoes in disease endemic areas, with a 'genetically modified mosquito' incapable of carrying the malarial parasite, and freeing large sections of the world's population from the daily tragedy of young lives lost to this deadly disease.





“Measurements are non-invasive and results available online and in real time, so the doctor can get a read-out immediately”



It is so sensitive that it is capable of detecting molecules that are present at the parts-per-billion, ppb, level of the exhaled breath, infinitely more sensitive than a standard breathalyser used for alcohol testing.

The technique has two major advantages over other ways of diagnosing illnesses: it is non-invasive, the patient simply breathes into a tube, making it particularly useful in paediatric medicine and for elderly and infirm patients, and the results are available online and in real time, so the doctor can get a read-out immediately.

Initially it will be used to study the breath of patients with renal disease, and help to identify

how effective their treatment is; another key area where it will be used is in the study of children with respiratory illnesses like asthma and cystic fibrosis.

Professors Smith and Spanel were working in astro-physics studying reactions that occur in interstellar space, when they realised their work could have a medical application, and they developed the SIFT-MS technique. With the installation of two devices in a new patient facility at Keele, their research will advance rapidly.

Professor Smith said: “The development of the instrumentation and technology has had to take place through the analysis of the breath

of healthy volunteers. This is a critical thing you have to do, but with the new building we now have the facility to bring patients into labs to do online, real time analysis of the breath and hopefully diagnose particular diseases.”

And Professor Patrik Spanel added: “Already we can detect maybe 10 different metabolites present in the breath of people, such as ammonia, acetone, isoprene, which can actually serve as valuable markers of various conditions when they are elevated outside the normal range, and some metabolites that are a clear marker of some disease like hydrogen cyanide.”

Said Professor Smith: “The two main areas that our resident paediatricians in this area are interested in are asthma and cystic fibrosis in young people. So we are now bringing the children in to look at the breath metabolites online, and in real time, and to look for molecules that are indicative of these diseases. If you can do this simply and non-invasively you can monitor therapy by giving the patient the appropriate drug and observing whether or not the disease is diminishing. An essential point is that these online measurements are straightforward and non-invasive with this new instrumentation.”

The sheer size of the machinery required was one of the limitations in developing this technique in the past, but it is now down to a manoeuvrable size, and they think it could be further reduced in the future to the equivalent of a shoe box, which could make wider distribution possible.

While clinical use is still in the early stages, breath analysis devices eventually could be seen in every GP's surgery as a standard means of diagnosis and used as a screening tool.

## Aluminium and Neurodegenerative Disease Research



Dr Chris Exley



The past twelve months have seen a number of significant studies related to human exposure to aluminium and chronic neurodegenerative diseases come to fruition in the laboratory headed by Dr Chris Exley. In a collaboration with Roger Bloor in Addiction Psychiatry they have published in the American Journal of Medicine the first observation of a link between smoking, either tobacco or cannabis, and an increased exposure to biologically available aluminium.

They have since followed this up to demonstrate that heroin use is also associated with a significantly increased body burden of aluminium. A collaboration with Clive Hawkins in Neurology has highlighted for the very first time a link between multiple sclerosis (MS) and aluminium. The results have been published in the journal Multiple Sclerosis and have proposed exposure to aluminium as an hitherto unrecognised environmental risk factor for the disease. A follow-up study is planned to investigate the nature of the proposed link.

Meanwhile, in a collaboration with Margaret Esiri at Oxford, a neuropathological examination of the brain of an individual exposed to aluminium in the notorious ‘aluminium poisoning’ in Camelford in 1988 has revealed a rare form of Alzheimer’s disease coincident with highly elevated levels of brain aluminium. The results were published in

the Journal of Neurology Neurosurgery and Psychiatry and have resulted in significant media interest including national TV news.

In connection with both of the aforementioned studies they have recently completed research in collaboration with Peter Crome in Geriatric Medicine in which they have demonstrated the reduction of the body burden of aluminium in individuals with Alzheimer’s disease simply through their regular drinking of a well known mineral water which is rich in silicon. They have spent the last twenty years or so highlighting that silicon is the ‘natural’ antagonist to the toxicity of aluminium and the present study, which is published in the Journal of Alzheimer’s Disease, is the first application of the hypothesis in human disease. This study has created quite a stir and discussions are ongoing with mineral water companies as to the implications of this research for Alzheimer’s disease and other aluminium-related diseases.

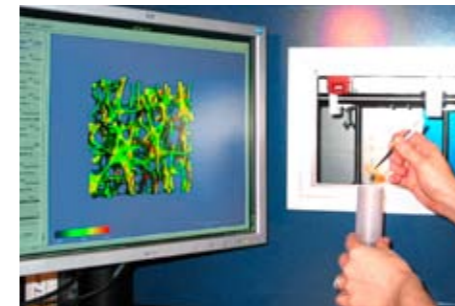
## Fast Translation Healthcare

### Tissue Engineering a 'growth' area for the future...

Think of 'engineering' in the twentieth century and the image in mind is likely to be of heavy machines, concrete structures, or perhaps high technology electronic products. But the growth of engineering in the twenty-first century is likely to be in applying technical solutions to the cells and tissues of the human body. Keele's leading research in tissue engineering has continued to expand in several exciting directions. The Research Institute for Science & Technology, under the directorship of Professor Alicia El-Haj, has received European funding to become a European Centre of Excellence in Tissue Engineering, and is promoting the field internationally to bring advanced engineering approaches into many areas of clinical practice.



Professor Alicia El-Haj



Keele is uniquely placed to develop several parallel aspects of tissue engineering. Within the Faculty of Health can be found research on the cellular phenomena of human tissues, particularly bone and cartilage, leading to the growth of those tissues for clinical treatments and surgical repair with a strong underpinning from the engineering field. A new and exciting theme, potentially leading to a large number of clinical applications, is the investigation into the use of bioartificial organs and tissues for replacement surgery. The tissues are grown in 'bioreactors' that permit the shape and structure of new skin, bone and cartilage to be controlled in the laboratory. Alternatively, the patient's own body can be the 'bioreactor'. New bone can be 'grown' within the human body in a few weeks, on an existing bone or within a muscle. It can then be transplanted to where it is needed, thus overcoming many of the problems associated with re-implanting cells grown in the laboratory. The new research building located on the hospital site at Hartshill includes new GMP facilities for growing human cells from patients to develop new cell therapies in tissue engineering in preliminary clinical trials.

Other novel areas introduced over the last few years include research into spinal cord, intervertebral disc, biomagnetic gene and cell targeting, and cell encapsulation strategies for

applications such as the pancreas. Biomagnetic strategies are being applied to control cells and tissue development through the design of novel bioreactors using magnetic fields applied to ferrofluids and cells that have been tagged with magnetic nanoparticles and delivered in vivo. Research is also under way into the environment into which tissue engineered constructs may be implanted, for example the histopathology and biochemistry of muscle and joints involves identifying and understanding key biochemical markers for musculoskeletal turnover and inflammatory disease such as Rheumatoid Arthritis and Osteoarthritis.

#### New bone can be 'grown' within the human body in a few weeks, on an existing bone or within a muscle.

Proof that the Institute for Science & Technology in Medicine successfully integrates the work of biological scientists, physicists, chemists, engineers, mathematicians and clinicians came during 2005, when the Institute won a tenth of the entire research funds from the BBSRC/ EPSRC Stem Cell Science & Engineering Initiative against fierce competition throughout the UK. It was a condition of submission that proposals involved formal collaboration between stem cell biologists and engineers or physical scientists, to which Keele could respond very well. Two grant applications were successful, each of three years' duration and totalling approximately £600,000. This double success will ensure that Keele remains at the forefront of the field. Work started on both projects in spring 2006.

## Tackling Chronic Musculoskeletal Pain

The proportion of older people in our society is set to increase over the next twenty years and beyond, and the number of people disabled in their daily lives or dependent on health and social care will rise. The main health problem experienced by this group will be chronic painful conditions of the muscles, bones, and joints, such as back pain and osteoarthritis. Musculoskeletal problems cause more disability than heart disease or cancer.

Hospital treatments, however good, will not reverse this trend. They have been identified as the main reason for the predicted rise in the number of older people who will become dependent on health and social care in the next 25 years.

These painful musculoskeletal conditions are the commonest cause of disability and work loss in Britain. Most sufferers look after themselves or are cared for by health professionals outside the hospital system in primary care. They form the largest group of long-term consulters in primary care.

Keele's Primary Care Musculoskeletal Research Centre researches the causes, consequences and treatments of common musculoskeletal problems seen daily in primary care. The aim of this research is to find out what happens over time to people who suffer from these problems, and how best

to prevent and treat their pain and restricted activity. The Medical Research Council, Arthritis Research Campaign and Department of Health have all acknowledged the importance of the work in delaying the outset of disability and developing new strategies for the management of these conditions in primary care through awarding grants of over £8.6 million in the past five years.

The Centre represents a unique collaboration between different clinical and academic disciplines, such as general practitioners, physiotherapists, rheumatologists, statisticians, epidemiologists, psychologists, social scientists and informatics experts. Its research programme is a joint venture between the University and a group of local Primary Care Trusts which form the North Staffordshire Primary Care NHS Research Consortium. The Consortium secures a whole range of health service support to underpin their clinical research and also enables them to involve patients in identifying the most important research questions to address



## Ethics and Society

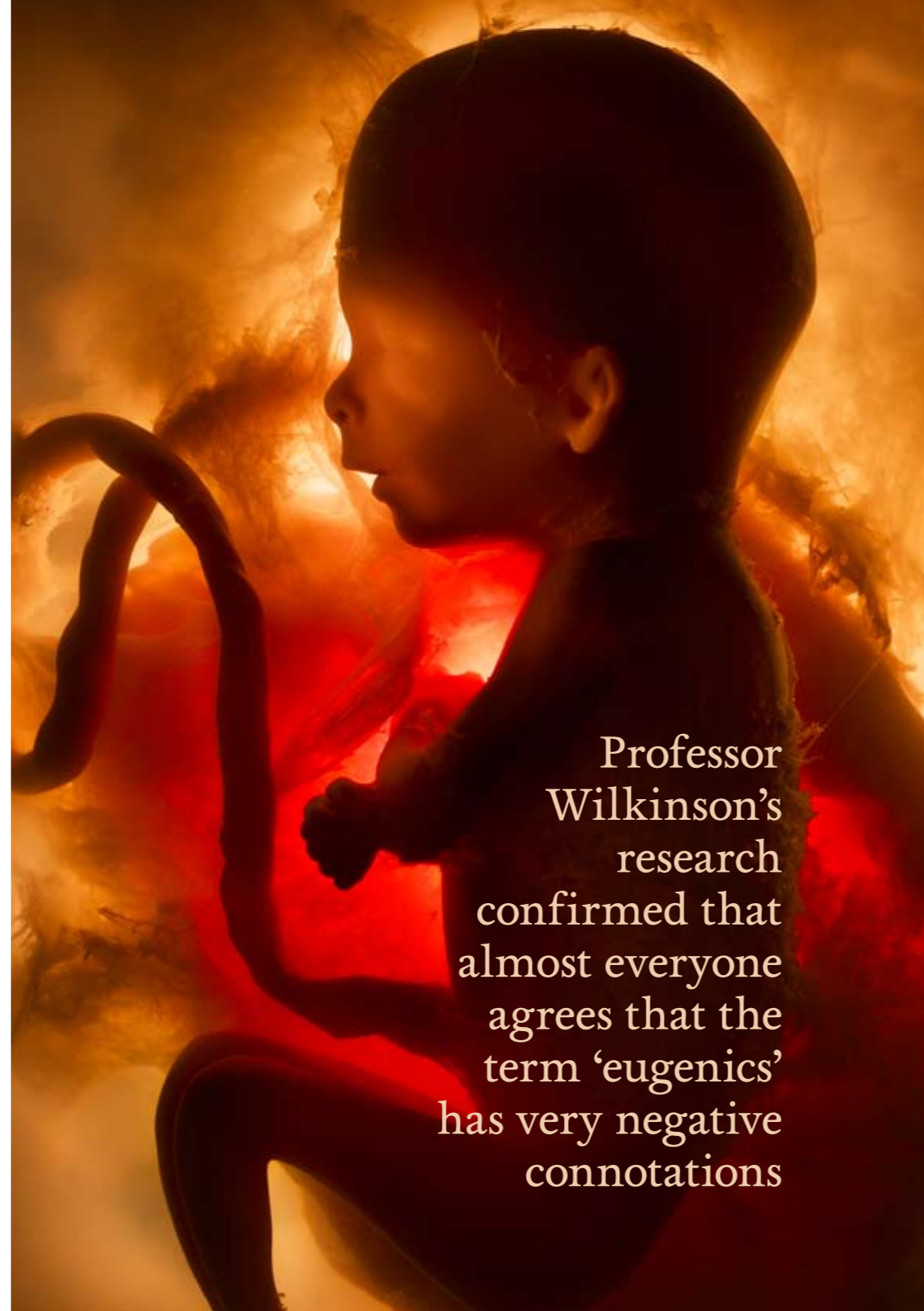
### EUGENICS AND GENETICS:

The role of the concept of 'eugenics' in contemporary debates is about the regulation of genetic and reproductive technologies



Professor Stephen Wilkinson

'Eugenics' is an accusation repeatedly levelled at genetic and reproductive technologies. Practices on the receiving end of this critique include prenatal screening and testing, and pre-implantation genetic diagnosis (which involves the testing and selection of embryos). Professor Stephen Wilkinson's project, supported by the Wellcome Trust's Biomedical Ethics Programme, sought to identify the function of the concept of 'eugenics' in contemporary UK debates about genetic and reproductive technologies, and to analyse and critically assess the way in which the term 'eugenics' is used in discussions of practice and policy. In addition to the documentary and analytical parts of the project, he interviewed a number of campaigners and representatives of special interest groups in order to deepen his understanding of their arguments, views and concerns.



Professor Wilkinson's research confirmed that almost everyone agrees that the term 'eugenics' has very negative connotations

Professor Wilkinson's research confirmed that almost everyone agrees that the term 'eugenics' has very negative connotations. Beyond that, however, there is considerable disagreement. People using the term 'eugenics' to criticise reproductive technologies appeal to a very wide range of concerns and disagree amongst themselves about what is wrong with eugenics. For example, some object to 'eugenic' selection practices because they involve the destruction of embryos, whilst others are worried about long-term effects on social justice, or about whether prospective parents' choices are sufficiently free and informed.

'Eugenics' also appears, in one respect at least, to be like the expression 'unborn child'. Many people with 'conservative' moral views use this to draw attention to (alleged) similarities between foetuses and (born) children; whilst those with 'pro-choice' views generally avoid the expression. Something similar can be said of 'eugenics'. Those hostile to, for example, embryo selection technologies often use the term 'eugenics' to draw attention to (alleged) similarities between these technologies and the 'eugenic' atrocities of the past; whilst those who support selection technologies generally don't use the word 'eugenics' in order to avoid drawing attention to these (alleged) similarities.

Professor Wilkinson, who is a member of the Research Institute for Law, Politics and Justice, continues to carry out research in this area and is presently working on an AHRC-funded project entitled Ethical Arguments against Selective Reproduction: a philosophical analysis.



## From Cradle to Grave

Members of the Research Institute for Life Course Studies (ILCS) are working on a diverse range of social issues affecting people from childhood through to old age. Their research draws on Keele's strengths in the fields of gerontology, sociology, psychology, social policy, social work and health.

Much work has a developmental focus; Research by Professor John Sloboda and Dr Alex Lamont looks at children's musical preferences development and how people learn to become skilled musicians. Others in Psychology are researching the effect of mothers' beliefs on infant feeding practises, whilst work with older children examines their reactions to bullying, issues of loneliness and trust, and their beliefs about the world.

Current research explores factors such as neuropsychological state, clinical condition or external influences, like the consumption of drugs or other substances. Work supported by a variety of charitable organisations is being undertaken by Dr Nicky Edelstyn on patients with Cotard's

delusion (a syndrome in which people believe they are dead or missing parts of their body), schizophrenia, and Parkinson's disease. Research on memory, social cognition and time perception is also being conducted.

Research on aspects of later life is an internationally recognised strength of the Institute, based within the Keele Interdisciplinary Research Centre on Ageing (KIRCA) and focuses on three key areas: social aspects of ageing conducted primarily by the Centre for Social Gerontology; health-related research on ageing; and the evaluation of health and social care policies for older people. Members of the Centre, headed by Professor Thomas Scharf, are involved in a variety of policy-relevant studies around forms of disadvantage in later life and on ageing in particular types of environment. Anchor Housing Trust has commissioned the first phase of its programme exploring the development of its purpose-built retirement community.

With Department of Health support, iLCS hosts the West Midlands Stroke Research Network, which aims to facilitate multi-centre stroke trials in hospitals and the community. Dr Roger Beech, Director of KIRCA, is involved in the national evaluation of the Partnership for Older People Project, which aims to support independence, dignity and self-reliance for people over 50, focusing on the development of community services.

Over 50s are the focus of the ESRC funded 'Baby Boomers' project headed by Dr Rebecca Leach. Funded by the ESRC/AHRB 'Cultures of Consumption' programme, the study explores the consumption patterns of the 1945-54 birth cohort as they near retirement. Other social science researchers in the Institute are working on social relations, everyday practises and domestic life, exploring questions of risk and lifestyle choice in the context of domestic consumption, parenting and sexual behaviour, plus policy-orientated work relating to child protection, education and rural communities.

## Collating our Literary Past

# Editing the Turbulent Dean



Jonathan Swift combined political influence at Westminster and high office in the Church (Dean of St Patrick's Cathedral in Dublin from 1713 until his death in 1745) with a career as a controversial and biting satirist. His appetite for political controversy frightened professional politicians, whilst his questioning of human rationality unsettled his pious contemporaries.



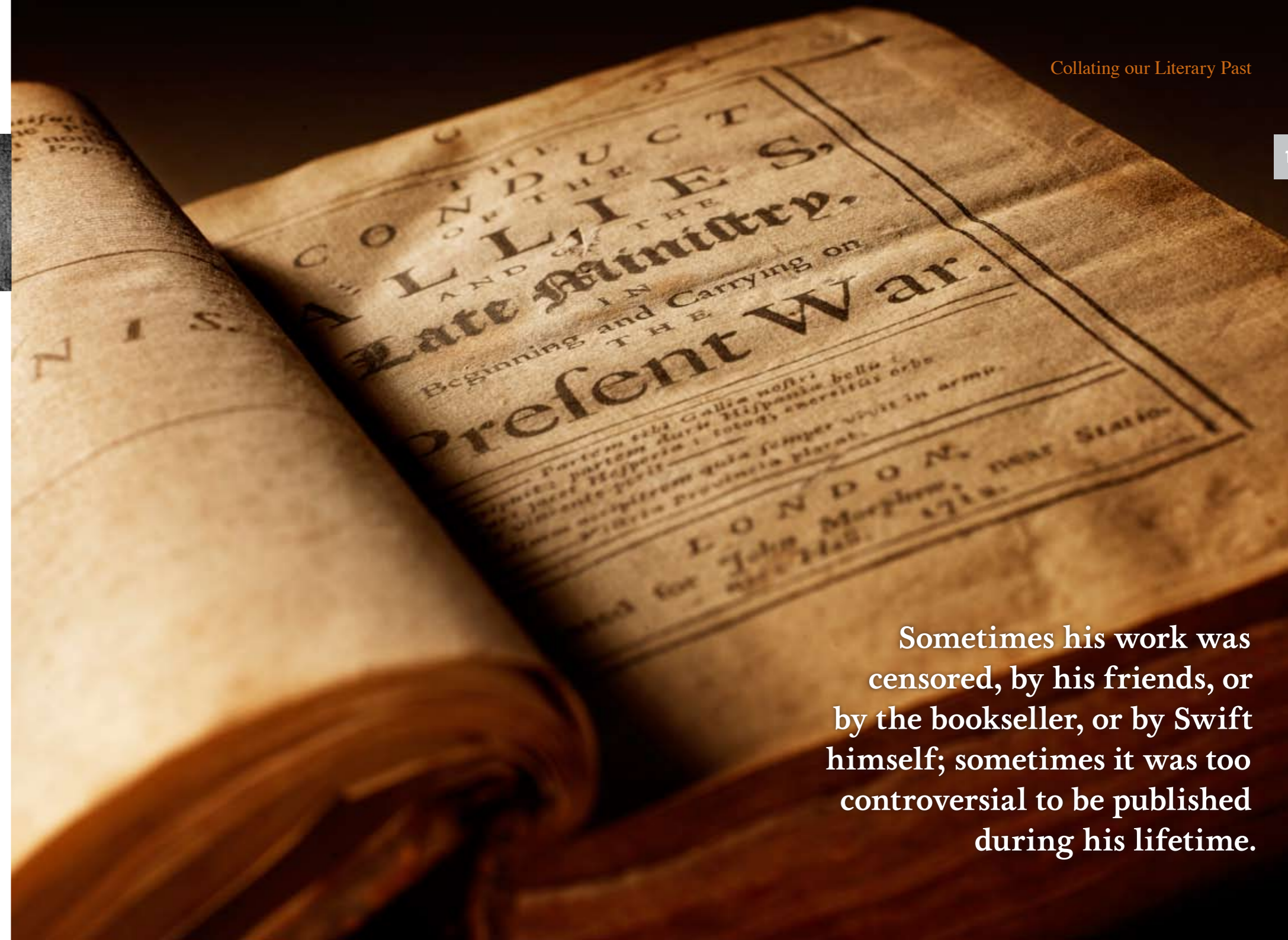
Professor Jim McLaverty

Often his satires, published anonymously, offended the authorities. Early in his career £300 was offered to anyone who could identify the author of his *Publick Spirit of the Whigs*; later his printer John Harding was put in prison for protecting his anonymity. Sometimes his work was censored, by his friends, or by the bookseller, or by Swift himself; sometimes it was too controversial to be published during his lifetime. Now, for the first time, all his work, in all its significant versions, both censored and uncensored, will be made available in a combination of print and online editions.

With a grant of over £530,000 from the Arts and Humanities Research Council, Professor Jim McLaverty and Dr Adam Rounce of English in the Research Institute for Humanities are leading a team of scholars in the preparation of a complete annotated edition of Swift's works. In collaboration with another team at Oxford, and general editors in America and Australia, they are directing the preparation of the Cambridge Edition of the Works of Jonathan Swift, to be published in fifteen print volumes between 2007 and 2010, with a companion

Swift archive which will present and collate versions of the texts that have not been fully available since their first publication in the early 1700s.

*Gulliver's Travels*, with its visits to the tiny Lilliputians and giant Brobdingnagians, is Swift's best-known work, and has been adapted as a children's book and film. But when it was first published in 1726 it was subjected to censorship by a clergyman friend of the bookseller and the manuscript destroyed. Swift tried in vain to recapture his first version, compiling lists of corrections and creating interleaved copies, as well as printing a revised version in 1735. The 1735 version will be available in the printed volume, but twelve other versions (including the first) and all the lists of corrections will be made available in the archive. Jim McLaverty is himself editing the two volumes of poems with Professor James Woolley of Lafayette College, Pennsylvania, and they will print for the first time some versions of the poems that were circulated in manuscript, including a new poem by Swift recently discovered by Professor Woolley, that shows the Reverend Doctor's abiding interest in matters scatological.



Sometimes his work was censored, by his friends, or by the bookseller, or by Swift himself; sometimes it was too controversial to be published during his lifetime.

## Social Evolution



Dr Barry Godfrey

## Foundations of Modern Sociology

Members of the Research Institutes for Humanities; Life Course Studies; and Law Politics and Justice are currently exploring the origins of British sociology using the records of the Institute of Sociology (IS) which worked in Britain in the first half of the 20th Century.

Despite the history of the IS being virtually unresearched, IS members were central in founding sociology in Britain. They founded the Sociological Review, contributed to early university teaching of the subject, published numerous books and papers on society, industrial and social relations, architecture, garden cities, class and race.

When the Institute was eventually dissolved the archives of the IS were given to Keele University, where it remains. Renamed the Foundations of Sociology Archive, the collection extends to over 15,000 publications, books, pamphlets and hundreds of parcels and boxes containing archival material (over 150 linear metres) relating to life in English towns (and also in selected European towns). Dr Barry Godfrey said the archive now provides a platform for a number of research projects and a series of related research symposia. It is a unique and largely unexploited resource of historical data on



social networks and spatial organisations between the 1880s and 1950s, particularly in relation to debates about appropriate strategies for reducing poverty and enabling people to live decent 'civilized' lives. The personal letters, biographical data, institutional correspondence, newspaper cuttings, draft speeches, reports of meetings, published plans, town and regional surveys, investigations of contemporary urban life (leisure activities of young people, 'pub-life' and public leisure activities; investigations into the living conditions, household arrangements, diet, working and entertainment activities of local communities in London and the provinces) are invaluable for placing ideas about respectability and civility within their social and historical context. The archive material also provides a valuable and unique insight into the thinking of some of the most well known writers and academics of the period, including H.G. Wells, Emile Durkheim, and Francis Galton.

# Gender, Work and Organisation

Annie Dempsey,  
Journal Administrator

*Gender, Work and Organization* now ranks among the UK's top international refereed journals, particularly in the fields of women's studies and social issues.

Since its launch in 1994, the world-renowned journal *Gender, Work and Organization* has gone from strength to strength. Professors David Knights and Jill Rubery established the journal in Manchester University where it resided until 2000 when it moved with David to Keele University. Dr Deborah Kerfoot joined David as joint editor within the Research Institute for Public Policy and Management, and the journal has increased its ranking and size and is now seen as a world leader in its field of gender at work.

Social sciences research is reflecting culture's increasing concern with gender, and *Gender, Work and Organization* now ranks among the UK's top international refereed journals, particularly in the fields of women's studies and social issues. In terms of impact, it ranks as the 4th from the top worldwide in journals focused on social issues and women's studies. It is the first journal to bring together a wide range of research in the field of gender into an international forum for debate and analysis.

Contributions are invited from all disciplinary perspectives including anthropology, history, labour economics, law, philosophy, politics, psychology, and sociology. The range of contributions in *Gender, Work and Organization* includes, for example, articles on the problems of conceptualising paid and unpaid work, on the labour process of prostitution and on the comparative position of women in professional work in France and Britain.

The journal, which is published by Blackwell Publishing, presents critical and scholarly research in a

clear and uncomplicated style from a diverse range of fields of inquiry and provides a platform for academic articles that give focus and credibility to gender issues.

One or more special issues are also produced each year, and topics covered have included the economics of equal opportunities, culture change in organisations, and gender discrimination in academia. Forthcoming special issues include: Gender and Time; Gender and Emotion; and Gender and the New Economy.

Dr Kerfoot and Professor Knights also organise a biennial *Gender, Work and Organization* conference attracting around 300 international scholars, where such wide-ranging topics as power and resistance; gender and technologies; romance, love and organisation; social exclusion; and feminist theory can be discussed. Keynote speakers at the conference are international stars in the field of gender studies.

**The next conference takes place at Keele University 27 to 29 June, 2007. Contact [d.kerfoot@mngt.keele.ac.uk](mailto:d.kerfoot@mngt.keele.ac.uk) for more information**



## Sustainability

The Ministry of Defence dropped its objections to the building of wind farms in a wide area around one of its military installations, in a major turning point in Britain's policy of developing wind power after ground-breaking research by scientists from Keele University.

# WIND ENERGY SOLUTION HELPS UK MEET KYOTO TARGETS



The work by the Applied and Environmental Geophysics Group helped resolve an impasse, which had prevented 40 per cent of UK renewable wind energy being developed.

In order to meet, and in fact exceed, Kyoto targets, the UK Government has set a challenging target of reducing the UK's carbon dioxide emissions by 60% by 2050. The development of renewable energy, especially wind power, will

be an important contributor to the success of that policy. Some 40% (in excess of 1 Gigawatt), of this wind generation capacity, was planned for the southern uplands of Scotland.

However, the United Kingdom seismic monitoring site which constitutes our component of the Comprehensive Test Ban Treaty compliance for nuclear testing is situated at Eskdalemuir near Langholm in the Scottish Borders. The Ministry of Defence therefore placed a precautionary blanket objection to any wind farm developments within 80km of Eskdalemuir in case this compromised



Professor Peter Styles

our capacity to detect distant nuclear test and breached our agreement under the CTBT, effectively removing at least 40% of the UK renewable wind resource identified by the DTI.

Because of their previous, unique experience in monitoring seismic vibrations from wind turbines in the UK, the Applied and Environmental Geophysics Group were asked by the MOD, the DTI and the British Wind Energy Association to

investigate whether there was a solution to this situation. By carrying out a detailed programme of seismic and infrasound measurements in the vicinity of several wind farms in Scotland, they were able to identify the characteristic frequencies and mode of propagation of seismic vibrations from wind turbines and develop a model for the integrated seismic vibration at the Eskdalemuir site which will be created by any distribution of wind farms. By setting a noise budget which is permissible at Eskdalemuir without compromising its detection capabilities, they have demonstrated that at least 1.6 Gigawatts of planned capacity



can be installed and have developed software tools which allow the MOD and planners to assess what further capacity can be developed.

The Keele team have shown that wind turbines would in fact have no significant impact on the equipment as long as they were positioned further than 17.5km from the seismic array. The MOD has now lifted the 80km exclusion and any further wind farm proposals will be assessed against

criteria established by this study. The exclusion zone has now been reduced to just 10km from the Eskdalemuir seismic array, with the recommendation that any wind turbines built within 17.5km will be made to an improved design to minimize vibrations.

Professor Peter Styles, Director of the Institute for the Environment, Physical Sciences and Applied Mathematics, received the 2005 award for the most Significant Contribution to Onshore Wind Energy, which is awarded annually by the British Energy Association, on behalf of the University and the Research Group.

UK Energy Minister Malcolm Wicks said:

"Eskdalemuir is an excellent example of how industry and government departments can work together to solve problems that could impede progress towards our energy and environmental goals. This agreement is based on solid research, and reflects the goodwill and constructive approach shown by all the parties. It is a welcome boost to our efforts to build a sustainable future energy supply that doesn't harm the environment."

MOD Under Secretary of State Don Touhig said:

"I am delighted that, together with the DTI, BWEA, and other stakeholders, we have found a way which has allowed MOD to lift its concerns with a significant number of proposed wind turbines around Eskdalemuir. The way forward, based on the excellent research carried out by Keele University, protects the capability of the array thus allowing us to continue to comply with our obligations under the Comprehensive Test Ban Treaty. This has, from start to finish, been a splendid example of open and joined-up working to solve a complex issue."

## Incorporating Sustainability

The research of Dr Gordon Rugg, Institute for the Environment, Physical Sciences and Applied Mathematics, has involved developing better ways of eliciting and checking requirements for sustainable development.

Building sustainably involves new types of requirement and new stakeholder groups in the building process. This causes numerous problems as sustainability takes on an increasing importance worldwide. An apparently straightforward design change can have unexpected knock-on effects.

A decision has to be made as to where each profession's responsibility ends; what should be decided by the sustainability expert, and what by the structural engineer?

Clarifying and systematising requirements is difficult, and is a familiar problem in software development. Research has found that a key issue was human cognition; stakeholders forget to mention their requirements, or have difficulty articulating their requirements, for predictable reasons rather than because of random error.

The research of Dr Gordon Rugg has involved developing better ways of eliciting and checking requirements. He is about to apply these methods to sustainable building.

One focus is the earliest design stage, using techniques such as laddering to clarify systematically what stakeholders want and why they want it. Another is ensuring that sustainability is systematically incorporated into requirements. A third is cultural issues: incorporating knowledge from other cultures with different insights into sustainability, identifying the role of sustainability in our own culture, and facilitating understanding between the very different professional cultures involved in sustainable building.



Dr Gordon Rugg



Professor Andy Dobson (left) Dr Stephen Quilley (right)

## Sustainability as a Vehicle for Competitive Advantage: ecological redevelopment, strategic marketing and the University campus

Although an important feature of the strategic landscape for both the private and public sectors, sustainability often proves an elusive goal. The up-front cost of investment in new hardware and buildings combined with the strategic risks associated with transforming established managerial practices and business models, often makes both public and private sector managers wary of embracing the agenda for sustainable development.

Organised by Dr Stephen Quilley and Professor Andy Dobson, of the Research Institute for Law, Politics and Justice, along with Dr William Young, director of the Sustainability Research Institute at Leeds University, the seminar series will run for 18 months from October 2006, and will tackle the many questions surrounding sustainability.

The point of departure for this seminar series is the extent to which the costs of environmental 'good citizenship' can be offset by short-term marketing opportunities as well as the longer-term benefits that may come from anticipating the wider trajectory towards environmental regulation.

The ecological redevelopment of universities will be used as the focus for an exploration of this topic. A range of participants including academics, university managers and private sector consultants will be given the opportunity to examine the implications of sustainability for universities.

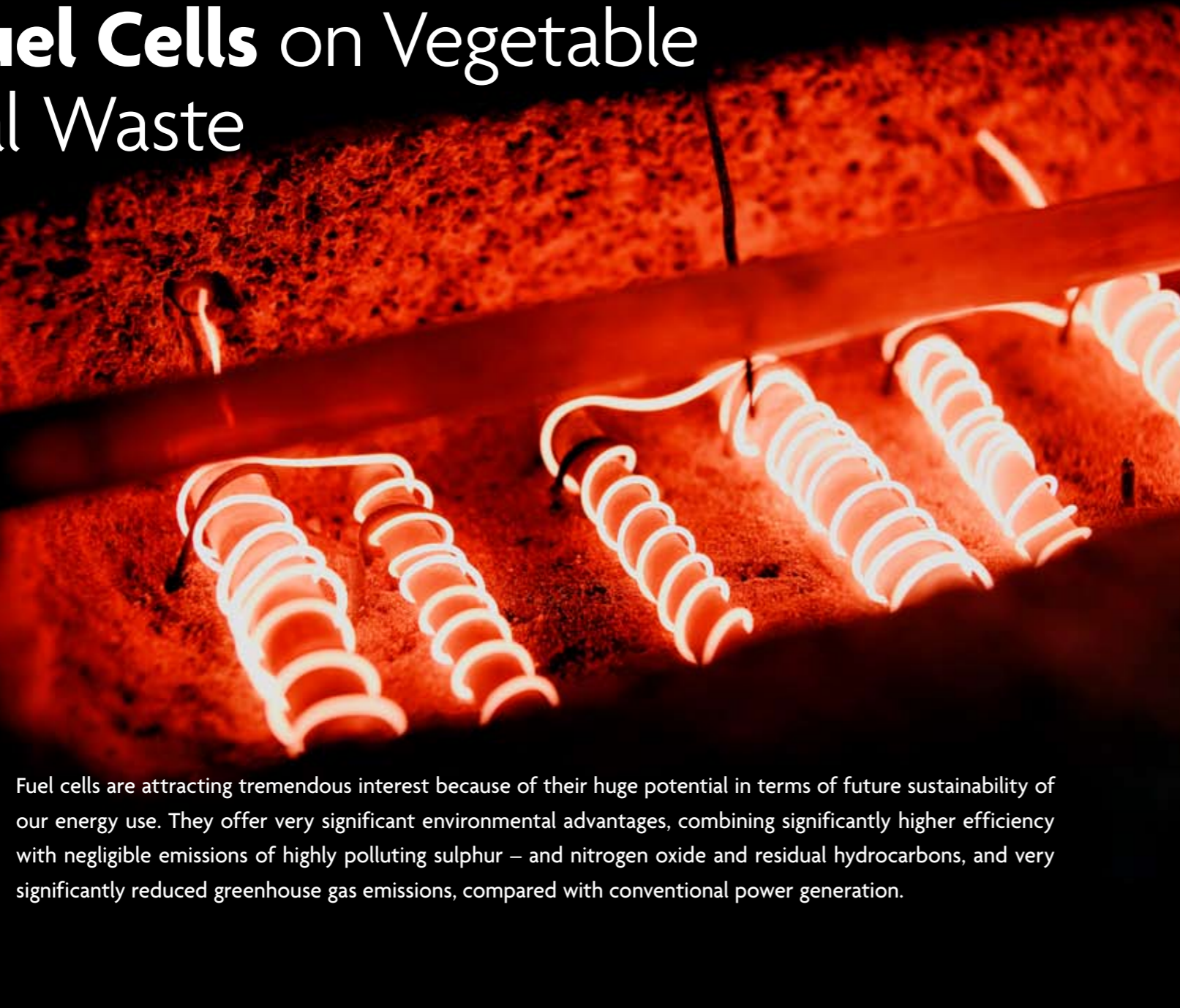
While the technical dimensions of the problem relating to energy usage, construction methods, recycling and 'campus metabolism' etc. will provide a context for this discussion, an important focus will be on the business/marketing and research/teaching opportunities. Sessions will address issues such as the built environment, logistical systems and procurement, competition in the global HE sector, marketing and eco-branding, funding, and the environment as an integrating theme in teaching and research.

After a concluding conference in 2008, the organisers expect the programme to generate both journal articles and a book. This Economic and Social Research Council success is also helping to consolidate the agenda of the active and increasingly successful 'Environmental Initiatives Group' – an interdisciplinary group straddling the Research Institute for Law, Politics and Justice and other research institutes, particularly the Research Institute for the Environment, Physical Sciences & Applied Mathematics within the University.

# Running Fuel Cells on Vegetable and Animal Waste



Professor Mark Ormerod



Fuel cells are attracting tremendous interest because of their huge potential in terms of future sustainability of our energy use. They offer very significant environmental advantages, combining significantly higher efficiency with negligible emissions of highly polluting sulphur – and nitrogen oxide and residual hydrocarbons, and very significantly reduced greenhouse gas emissions, compared with conventional power generation.

Solid oxide fuel cells (SOFCs) offer potential advantages in terms of efficiency, flexibility and cost over other types of fuel cells because of their tolerance to carbon monoxide, their increased resistance to poisons and impurities in the fuel and because their high operating temperatures allow the possibility of running the fuel cell directly on natural gas and other practical hydrocarbon fuels, catalytically processing the fuel directly within the fuel cell, which both increases efficiency and reduces complexity.

Biogas is a complex and variable mixture of methane, carbon dioxide and other gases. It is a cheap, extremely abundant, readily available and renewable but very under-exploited energy reserve, produced in huge quantities from domestic and industrial waste, animal waste and vegetable matter. One of the principal limitations in its utilisation as an energy source is its variable composition and often low level of methane, which presents major difficulties in its use in conventional power systems. Consequently large quantities of biogas are presently vented to the atmosphere making a very significant contribution to detrimental greenhouse gas emissions, and hence climate change, whilst at the same time wasting a potentially clean, renewable energy resource.

Professor Mark Ormerod and his research group at Keele have been working on solid oxide fuel cells for over ten years, with a particular focus on research leading to the development of SOFCs that can run directly on practical hydrocarbon fuels. In recent years, much of the group's research has focused on the possibility of using biogas, whether produced from domestic and industrial waste, animal waste or vegetable matter, as a possible renewable fuel source for SOFCs. The Keele group has demonstrated that it is possible to run a solid oxide fuel cell both indirectly and directly on different

forms of biogas, over a wide compositional range, converting the methane present into electrical power and useful energy, even when the biomass and biogas is depleted in methane. Thus at methane contents at which conventional heat engines would have long since stopped working, the fuel cell is able not only to function but to produce energy from poor-quality biogas, which is presently disposed of by simply venting wastefully and detrimentally to the atmosphere.

**Solid oxide fuel cells potentially offer a way of generating useful renewable energy from waste matter with very significant environmental benefit in terms of reduced greenhouse gas emissions and climate change.**

Thus solid oxide fuel cells potentially offer a way of generating useful renewable energy from waste matter with very significant environmental benefit in terms of reduced greenhouse gas emissions and climate change. Professor Ormerod's group's current research is directed towards utilisation of different forms of biogas, including chicken and pig slurry, farm waste and landfill gas, and studying the effect of variable composition of the biogas and the tolerance to high levels of sulphur, ammonia and other impurities present in some forms of biogas.

## CORROSION PROBE a novel technique to test steel reinforcing bars

The maintenance of large concrete structures, such as tower blocks and motorway bridges, requires effective survey techniques. One of the main causes of structural failure is corrosion of the steel reinforcing bars embedded within the concrete. Current survey techniques for detecting corrosion are either invasive or indirect, providing only a measure of the likelihood that corrosion may be occurring; all are relatively slow. Areas determined to be at risk are stripped of concrete and repaired by way of precaution even though some are ultimately found to be sound. Unnecessary surveying and repair causes additional disruption, pollution and cost.

The Detectors and Testing Group at Keele have worked with representatives of the concrete repair sector to develop a novel hybrid electromagnetic technique that allows the direct, definitive detection of corrosion on reinforcing bars embedded within concrete, or other non-ferrous materials, using a non-destructive and rapid method. In addition, this can be used in situations where other methods are not viable. The work has been supported by the EPSRC, industry and government departments both in the UK and elsewhere in the EU, with financial backing totalling in excess of £500,000. The Corrosion

Probe detects the presence of rust; future modifications will allow more detailed analysis of the nature of the corrosion.

A company, SciSite Limited, has now been spun out from the university, with financial support from AWM, and uses the new Corrosion Probe to provide a survey and consultancy service to the concrete repair sector. The petrochemical and heritage building sectors are also showing keen interest.



## Searching for New Planets



# SUPERWASP

## Search for the planets

The search for planets orbiting stars outside our Solar System (extrasolar planets) is one of the most competitive and exciting fields in modern astronomy. Only about 200 extrasolar planets are currently known, and many questions about their formation and evolution remain unanswered.

Astrophysicists at Keele are playing a key role in a world-class project to find extrasolar planets by monitoring hundreds of thousands of stars every night. The Wide Angle Search for Planets (WASP) is a consortium of UK universities and observatories that has built and operates the SuperWASP instruments in the Spanish Roque de Los Muchachos Observatory on La Palma and at the Sutherland station of the South African Astronomical Observatory.

Funding for the Sutherland Station came from a successful SRIF bid by Keele, who built and operate the instrument. The extremely wide field of view of SuperWASP, 2000 times greater than a conventional astronomical telescope, combined with its ability to measure brightness very precisely, allows it to view large areas of the sky and accurately monitor hundreds of thousands of stars every night. When sufficient observations have been made, searches for changes in brightness are made by sophisticated custom-built software.

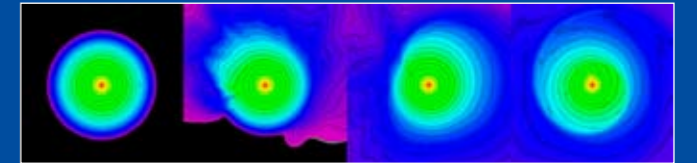
Stars which show the characteristic 1% dip in brightness lasting a few hours every few days are followed-up using observations on larger telescopes to confirm the presence of a planet. Observations in collaboration with astronomers in France and Switzerland were used to confirm the first two planets discovered by SuperWASP in September 2006. This result was widely reported in the national and international media.

Keele's astrophysicists are also part of the Southern African Large Telescope (SALT) consortium. This groundbreaking project enables astronomers from an international consortium of institutions, to study more closely the lives and deaths of stars, and the origins of the universe. The gigantic telescope, with its 11-metre-wide mirror, is the largest single optical telescope in the southern hemisphere.

Keele astrophysicists also make use of telescopes in space, including the NASA Hubble Space Telescope, Spitzer Space Telescope and Chandra, and the European Space Agency's XMM-Newton X-ray observatory.

## A Substellar Jonah – the brown dwarf that was swallowed by a red giant and survived

Image: Steven Diehl, Chris Fryer, Falk Herwig and Gabriel Rickerfeller.



Dr Pierre Maxted, IEP5AM, Astrophysics, and colleagues from the Universities of Hertfordshire and Leicester, have discovered an unusual white dwarf star – the binary star WD0137-349, which may have a dull name but has an exciting past.

The star was already known to be a white dwarf – a dense object about the size of the Earth but 100,000 times heavier. They are formed when a star like the Sun dies. This white dwarf was observed as part of a programme to find close binary white dwarfs, i.e., those with a companion star that orbits them every few hours.

WD0137-349 showed signs of having an exceptionally low mass companion, so Dr Maxted applied for and was awarded two hours of Director's Discretionary Time on the Very Large Telescope at the European Southern Observatory in Chile. This conclusively showed that the companion is a brown dwarf – a 'failed-star' 20 times less massive than the Sun.

These objects are extremely rare, fewer than 1/200 white dwarfs have a brown dwarf companion of any sort and this is the first example of one in a close binary. The properties of WD0137-349 show that it formed when the brown dwarf ploughed into the outer layers of a red giant star about 70 times larger than the Sun. The shock waves generated threw off the outer layers of the red giant to reveal the white dwarf in the core.

# Research, Knowledge Transfer & Enterprise



## Social Enterprise

### Students in National Finals of Students in Free Enterprise – SIFE

Jessica Schneider and Christine Hughes, two first year undergraduate students, represented Keele for the first time in the 2006 SIFE UK national competition against 14 other university teams. SIFE, Students in Free Enterprise, is an international student enterprise organisation focusing on social responsibility and free trade, aiming to help students to learn through teaching others about enterprise in deprived and underprivileged areas of the community.

Jessica and Christine presented their development of a programme to 'Teach financial literacy to schoolchildren' to 12 key business representatives from companies such as HSBC, Wal-Mart and L'Oreal. They piloted their project at Sandon High School, Stoke-on-Trent, where it was filmed by Keele's media department.

Jessica Schneider (left) Christine Hughes (right)

## Knowledge Transfer at Keele University

The Office of Research and Enterprise at Keele plays a central role in the commercialisation of Keele's intellectual property, administration support to research programmes and the development of enterprise services to regional and national, public and private organisations. The Office nurtures and supports Keele's signature research themes, facilitates research of national and international importance and underpins a 'blue-chip' enterprise agenda which ensures the effective delivery of relevant outputs to beneficiaries.

### Trent City Securities Flora and Fauna Ecological Survey

Keele University undertakes terrestrial and aquatic surveys of sites. By implementing appropriate and ecologically recognised techniques, assessment of species present and their predominance at the site are determined. For example, both terrestrial and aquatic flora and fauna can be determined and the monitoring of birds and bats present on site can be undertaken.

### Keele 'Spin-out' Companies

A key component of Keele's Intellectual Property commercialisation activity is the creation of new companies, formed with the specific purpose of creating value from Keele research. Recent examples of this activity are as follows:

#### Intelligent Orthopaedics

Intelligent Orthopaedics is a spin-out from a consortium from Keele University, Staffordshire University and the University Hospital of North Staffordshire. The company produce the Staffordshire Orthopaedic Reduction

Machine (STORM®), which is a Class I reusable medical device designed to help orthopaedic surgeons achieve an anatomical reduction of unstable tibial fractures prior to fixation.

#### MagneCell

Formed in March 2003 to exploit novel technology from biomedical research at Keele University and the North Staffordshire NHS Trust. The patented technology concerns a new type of bioreactor for use in tissue engineering. Although in its early stages, tissue engineering aims to replace damaged tissues with healthy tissues grown from a patient's own cells or from a cell-line which does not trigger an immune response reaction in the patient.

## Student Placements

### Thumbs Up for Keele Placements

A promotional and merchandising company AdGiftsOnline, in Newcastle, Staffordshire took part in the Knowledge Innovation Technology Transfer Scheme (KITTS) programme offered through Keele University's Office of Research & Enterprise. Business Administration (Marketing) and International History graduate Matthew D'Arcy was successfully recruited to deliver a detailed marketing programme aimed at producing and implementing an integrated marketing programme.

Managing Partner of AdGiftsOnline, Tony Altham, emphasised the added value of recruiting from graduate projects such as KITTS, confirming his decision to participate in KITTS as "...being a good decision and a positive move for our business". Matthew was subsequently employed in a permanent position within the company.

## Regional Partnerships

The UK economy has seen a major shift from a traditional manufacturing base to a knowledge-based economy. This transition is critical to the regeneration of North Staffordshire. Keele is making great progress in assisting growth through its enterprise activities and expansion of its highly successful Science Park.

The Office of Research and Enterprise has developed strategic links with HE partners in the West Midlands and as a result has successfully bid for in excess of £10m collaborative funds to support University spin-out companies and Entrepreneurship development. In response to demand from academic spin-out companies and student start-ups, Keele has opened a new "Stepping Stones" Incubator on its Science Park to bridge the gap between academia and the business environment.

Closer links have been developed with local Risk Capital funds to aid the funding of staff and student start-ups. Professional Services networks such as **finest** in North Staffordshire are now supporting the Enterprise and Innovation agenda at Keele with the provision of specialist legal and accountancy services for knowledge-based SMEs on the Science Park.

## Organisations we have worked with:

- Smith & Nephew • Vauxhall Motors • Glaxo Smithkline • British Gypsum • BBC • Pilkington Ltd • Eli Lilly & Co Ltd • Dow Corning Ltd • J Sainsbury plc • Allied Irish Banks Ltd • BT • Astra Zeneca UK Ltd • British Gas • Unilever • BNFL • Rolls-Royce • Pfizer • Roche Pharmaceuticals • Syngenta Bioline • Nycomed • GE Healthcare • DEFRA • Novartis • Waterford-Wedgwood plc

## RESEARCH DEGREES AT KEELE UNIVERSITY

Postgraduate research is central to Keele's ambitions as a modern University. Often it is the work of research students that provides the basis for progress in an academic discipline, and in many of the professions.

The Graduate School is the university-wide organisation which has responsibility for research students. It works closely with the Research Institutes to ensure that all research students are provided with a high quality programme. It also has a responsibility to ensure the continuing training and development of contract research staff and other early career research staff.

Keele offers research degrees in a number of disciplines within the context of the Research Institutes. Students may apply for a PhD, MD, or MPhil programme, or for a Professional Doctorate programme – DBA (Health), EdD (Education) or DMedEth (Medical Ethics).

All research students are members of Research Institutes which are responsible for ensuring the provision of appropriate supervision, facilities and training, and for monitoring and managing the progress of their students.

For more information contact:

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## Keele University Science Park

The role of Keele University Science Park is to support the growth of innovative business, particularly those active in research and development within the West Midlands region, by providing a high quality location, state-of-the-art accommodation and a range of business support services. The Park is equally suitable for a wide range of companies from start-up businesses to existing and large businesses seeking to expand and relocate, as well as knowledge-based companies from overseas, across a broad range of science and technology sectors.

### University Links and Knowledge Transfer

The Science Park is located central to the main campus with immediate access to all academic, research, commercial, social and recreational facilities.

As a research-based University, Keele has nationally and internationally acclaimed strengths in key areas of high quality research activity. These include: cell and molecular biology, history, materials science, social science and information technology. Keele has a wide and diverse range of expertise in science including environmental science, clean technology, catalysis, photochemistry, medicinal chemistry, computational modelling and simulation and organic synthesis, crystal engineering, chemical ecology and organometallic chemistry.

Keele is keen to develop commercial collaborations with industrial and public sector organisations to realise and maximise potential in these and other areas.

Keele University Science Park is a designated priority investment site within North Staffordshire Regeneration Zone and is included in Advantage West Midlands' strategy as a cluster site for medical technology and healthcare based businesses.

This leading development allows companies to locate to an environment that provides an innovative research culture combined with academic expertise and the University's specialist resources. The Science Park currently accommodates some 40 high tech companies serving a number of different sectors, including biotech, medical, IT and the service industries.

The Science Park's most recent commitment to commercial enterprise is the Innovation Centre Developments which provide some 130,000sq ft of mixed use accommodation. The most recent additions to the portfolio are MEDIC3 and MEDIC4 providing specially designed hi-spec accommodation for innovative medical technology businesses. They offer a mix of high specification laboratory units, as well as high quality office accommodation and workshop space, with units starting at 250sq ft upwards. The Science Park also offers excellent opportunities for companies who wish to undertake Design and Build projects.

### Contact details:

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Keele, Staffordshire ST5 5NL  
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**Email:** c.s.mairs@kfm.keele.ac.uk  
**Website:** kusp.co.uk

An environment that provides an innovative research culture combined with academic expertise and the University's specialist resources



**K E E L E**  
UNIVERSITY

#### **INSTITUTE FOR HUMANITIES**

The Institute brings together researchers in History, English Literature, American Studies, Music, and Modern Languages to produce high quality disciplinary and interdisciplinary research in these fields.

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**Institute Manager**  
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#### **INSTITUTE FOR PRIMARY CARE & HEALTH SCIENCES**

The Primary Care Musculoskeletal Research Centre at Keele conducts high quality research in the primary care setting that is of relevance to the NHS and its patients, and contributes to developing the culture of research within primary care. It aims to ensure that their research informs clinical decision-making and improvements in health and establish more effective primary care management of common painful conditions.

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#### **INSTITUTE FOR LIFE COURSE STUDIES**

The Institute aims to support and stimulate high quality research and enterprise by bringing together a multidisciplinary group of researchers working on a range of health and social concerns across the life course, from childhood through to old age. It draws on existing strengths at Keele in the fields of ageing (with one of the largest groups of researchers working in the field of gerontology in the UK), children and families, health and well-being and psychology.

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**Institute Manager**  
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#### **INSTITUTE FOR LAW, POLITICS & JUSTICE**

The Research Institute for Law, Politics & Justice brings together researchers working in the broad areas of law and ethics, politics and international studies/relations, environmental politics and crime, security and justice. It also explores the intersections between these fields and is currently expanding into new related areas such as postcolonialism and cultural studies, police research, environmental sustainability, ethnicity, and migration.

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**Institute Manager**  
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#### **INSTITUTE FOR PUBLIC POLICY & MANAGEMENT**

The Institute for Public Policy and Management is made up of researchers with shared interest in questions of public policy, in the regulation and governance of institutions, and in managerial and organisational practices.

Their goal is to extend and deepen understanding of policy, institutions and management, their interrelations, their origins in broader political, societal, economic and cultural movements, and their effects.

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#### **INSTITUTE FOR THE ENVIRONMENT, PHYSICAL SCIENCES & APPLIED MATHEMATICS**

The Institute has strong interdisciplinary synergies and collaborates both internally and externally. Their goal is to achieve sustainable renewable solutions, whenever possible. Research is funded by research councils, major charities, overseas sources and industrial contracts.

The Institute is able to apply its experience and breadth of vision to a spectrum of research problems.

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#### **INSTITUTE FOR SCIENCE & TECHNOLOGY IN MEDICINE**

The Institute for Science and Technology in Medicine (ISTM) bridges the interface between new advances in basic science and technology with medicine and clinical practice, and successfully integrates biological scientists, physicists, chemists, engineers, mathematicians and clinicians.

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