Introduction

From Professor Mark Ormerod, Pro Vice-Chancellor (Research and Enterprise)

Welcome to the first edition of Discovering Excellence, which showcases a selection of some of the world-leading innovative research being carried out at Keele University, and shows how this research is tackling some of the most pressing challenges facing society today both regionally and globally, and is having a significant positive impact on our health and our social, cultural and economic wellbeing and the communities we serve.

As a strong research-led university, Keele is committed to research excellence, with world-leading research undertaken across health, natural sciences and the humanities and social sciences – much of it interdisciplinary. This research is helping to tackle global problems that impact across a range of issues including health, environmental sustainability and population ageing, our three overarching themes as an institution.

This edition gives an insight into research we are doing at Keele in the areas of providing new approaches to back pain, tissue engineering and regenerative medicine, cancer and malaria, the role of aluminium in biological systems, reducing energy consumption, ageing and social gerontology, living with HIV, discovering new planets, and taking musical composition to new levels using the latest digital technology.

Keele is proud of its thriving stimulating research environment which nurtures talent and actively encourages high quality research, much of which is interdisciplinary. Keele has always been a university which has given promising early-career researchers an opportunity to flourish and thrive and develop their own research profile, and I am delighted to include a section which focuses on just some of our rising research stars, who I am confident will become key international researchers of the future.

Over recent years our research activity has grown very substantially, with research grant income showing significant year-on-year growth, this year showing a further 10% increase on last year’s record income. This is particularly impressive given the increasingly competitive funding climate. Alongside this we have seen very impressive increases in our postgraduate research student population, with a 50% growth in research student numbers over the last three years, adding real vitality to our research culture and environment.

I hope you enjoy this first edition and it gives you a flavour of the wide range of exciting, high quality research being carried out by Keele staff, and I very much look forward to sharing more of Keele’s research in future editions.

Professor Mark Ormerod
Pro Vice-Chancellor (Research and Enterprise)
“Keele is proud of its thriving stimulating research environment which nurtures talent and actively encourages high quality research, much of which is interdisciplinary.”
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How does one find extrasolar planets, given that they are very distant and very dim and lost in the glare of their host star? The best planet-hunting method is to look for planetary ‘transits’. A small fraction of extrasolar planetary systems are sufficiently edge-on to us that we see the planets pass in front of their star, causing a slight dip in the star’s light. Such a dip is only 1% deep, even for the largest planets, but is detectable if enough data is accumulated on enough stars.

Since 2005, Keele Astrophysics Group has led the WASP-South survey, looking for transiting planets as part of the Wide Angled Search for Planets (WASP) consortium. On every clear night, out in the dark skies of South Africa’s Karoo desert, WASP-South opens its roof at dusk, and begins recording the Southern Hemisphere sky with an array of eight wide-field cameras.

“So far we’ve accumulated over 30 billion data points on over 30 million stars,” explains Keele astrophysicist, Professor Coel Hellier, Research Institute for the Environment, Physical Sciences and Mathematics, who leads the team that built WASP-South. With 40GB of data from each clear night, a mammoth data-processing task produces high-precision lightcurves of each star, and searching through these occasionally finds the tiny dips that reveal the passage of a planet.

“WASP-South has now found exoplanets around 60 different stars”, says Professor Hellier.

This is a success rate that makes WASP-South the world’s most successful facility for searching for transiting exoplanets. Further, WASP-South finds planets around relatively bright stars where they can best be studied.

“If we find a transiting exoplanet around a bright star, we can measure the mass and radius of the planet, and hence its density, and we can further investigate the details of its orbit and begin to figure out how it formed”, explains Professor Hellier. “All of the brightest such systems in the Southern Hemisphere were discovered with WASP-South, and our planets are the prime targets for the today’s and tomorrow’s largest telescopes.”

WASP-South is operated robotically over the internet, as featured on the BBC’s “Stargazing Live” in January 2012. Three million viewers watched the live link-up to WASP-South as hosts Brian Cox and Dara O’Brian issued a command to slew WASP-South into action, while Keele postdoc David Anderson explained how it worked.

The success of the WASP collaboration which, in addition to Keele’s WASP-South, involves a Northern-hemisphere counterpart operated by Queen’s University Belfast, together with software and archiving provided by the Universities of St Andrews and Leicester, led to WASP winning the 2010 Royal Astronomical Society’s Group Achievement Award. With WASP at 84 planets and counting, the nearest competitor is the HAT project, led by Harvard and Princeton, which has so far announced 38 transiting planets.

While transit searching from the ground is relatively cheap (WASP-South cost less than £1m), NASA’s Kepler mission, a satellite dedicated to the same task, cost $600m. “Because they are above Earth’s atmosphere they get much better photometry, and so can do things that we can’t”, explains Professor Hellier. “They can find small, Earth-size planets, such as the Kepler-20 planetary system.”

The Kepler team have now announced planetary systems as far as Kepler-35. But the drawback is that Kepler looks at fairly faint stars over a much smaller patch of sky, which means that many Kepler candidates are very hard to observe. The brighter systems found by WASP hold out a major promise, that we can detect molecules in the atmospheres of extrasolar planets, and hence learn what they are made of.

“Are there planets around other stars?” is a question that humans have pondered ever since it was realised that the stars littering our night sky are simply other suns seen at a great distance.
“To do this we observe the spectrum of the star in and out of transit and subtract the two”, explains Professor Hellier, “and the difference will show tiny spectral features caused by molecules in the planet’s atmosphere which absorb some of the star’s light.”

The WASP team pointed NASA’s Spitzer Space Telescope at the system WASP-12, and found that the atmosphere of WASP-12’s planet is dominated by carbon-rich molecules, in contrast to the oxygen-rich composition of Earth. This finding of a planetary system very different to our own was reported in Nature, and led to widespread publicity over the possibility of planetary cores made of diamond.

Such is the potential of ‘transmission spectroscopy’ of transiting exoplanets that both NASA and ESA (European Space Agency) are planning dedicated space missions to investigate exoplanet atmospheres. “Our task is to find the best targets for those missions”, states Professor Hellier, “we’re aiming to find a range of different-sized planets around the brightest stars, because those will be the systems that tell us most about how planets form and evolve.” The long-term goal is the possibility of detecting ‘bio-marker’ molecules in exoplanet atmospheres, molecules that could only have arisen as a result of life on those planets. It may be some decades before it is technically feasible to detect bio-markers in the atmospheres of Earth-like planets, but astronomers are already well on that road.”

“WASP-South has now found exoplanets around 60 different stars.”
A key development in cancer research was the recognition, more than 20 years ago, that cancer cells were not just abnormal in growing and dividing when they shouldn’t, but were also cells that were failing to die when they should. Healthy human cells were all found to self-destruct when they were damaged or became abnormal, but the mechanisms involved failed to operate in cancer cells, allowing them to increase in number and produce tumours.

The process of normal cellular self-destruction, called apoptosis, has therefore become the focus of research for many scientists, including the Keele Apoptosis Research Group, within the Institute for Science and Technology in Medicine, with the long-term aim of reactivating this mechanism to eliminate the cancer cells.

The Keele Apoptosis Research Group, funded by the research councils and by several charities including the Breast Cancer Campaign and Leukaemia & Lymphoma Research, has successfully identified several genes which play a key role in the normal process of cellular self-destruction, and which may therefore become abnormal during cancer development. One of these genes, called Fau, is reduced in breast cancer patients, and this reduction may well contribute to the failure of cell death which allows breast cancer to develop. In the future, monitoring levels of several genes, including Fau, may produce improvements in targeting breast cancer therapies to those patients who will benefit most.

Most recently, the Breast Cancer Campaign has awarded Keele University more than £200,000 for investigation of a second cell death-controlling gene, called GASS. GASS is a member of a class of genes, called non-coding RNAs, which have recently become the focus of a great deal of attention from biomedical researchers. These genes are now known to play surprisingly important roles in the control of cell death and cell growth. GASS in particular plays a critical role in controlling the behaviour of a broad range of cell types, from blood cells to breast cells. Since these genes have not previously been thoroughly studied, the research group at Keele will define the ways in which these important controlling effects are produced so that improvements in diagnosis and breast cancer therapy can be developed.

Gwyn Williams, Professor of Biochemistry in Keele’s School of Life Sciences, said: “Cancer is a complicated and difficult disease to combat. However, bit by bit, we are continuing to learn more about how cancer develops, and this new knowledge will provide the foundation for continuing improvements in cancer diagnosis and therapy. “Our group has gone back to examine the roots of cancer and has identified key molecules underlying cancer development and therapy resistance. It’s a long haul, but we hope to build on this to allow new therapies and diagnostic tests to be developed which will help significantly in the battle against cancer – one of the most important and challenging of all diseases.”

“Cancer is a complicated and difficult disease to combat. However, bit by bit, we are continuing to learn more about how cancer develops, and this new knowledge will provide the foundation for continuing improvements in cancer diagnosis and therapy.”
Aluminium

Professor Chris Exley
Body Burden of Aluminium

Keele continues to lead research into human exposure to aluminium

There is a burgeoning interest in human exposure to nanoparticulates, which are sub-micron sized particles that enter the body, potentially accumulating in tissues and organs. These materials are naturally present in many different environments and while there is evidence that such nanomaterials are becoming more widespread, it is also clear that we understand very little about their potential modes of toxicity.

A form of nanomaterial that has been used by humans for decades are aluminium-based adjuvants used in vaccination and allergy therapy. Professor Chris Exley leads a team at Keele University researching aluminium in biological systems. Its aim is to develop a better understanding of the physical and chemical properties of aluminium adjuvants and investigate how these properties influence the biological activity of these materials. In the long term, the team hope their research will help in the design of future safe and effective adjuvant materials and eventually optimise the toxicity of such materials so that they might additionally be used to kill tumour cells in cases of malignant brain cancer.

Professor Exley explains: “As the body ages, studies have shown that aluminium accumulates and deposits in the body and one area of the body where this is more likely to happen is the brain. We know that aluminium can be present in all cells of the body, but in the brain there isn’t the same turnover of cells that we see in other areas and therefore the deposits of aluminium are more likely to accumulate over time. It’s currently unclear what the impact of this burden of aluminium has on the body and our overall health and wellbeing, which is why we’re interested in exploring the pathology of the metal and to explore the properties of aluminium adjuvants. How does aluminium affect our bodies and can we use this knowledge to develop safe adjuvant materials”.

Professor Exley’s team has recently undertaken a study analysing 60 human brains and the metal content within them. Interestingly, the research has found a link between amyloid beta deposits – often implicated in the aetiology of Alzheimer’s disease – and the burden of metal in brain tissue, leading to a theory that dementia might be predicted by a combination of amyloid pathology and the ratio of copper and aluminium in the brain. Further in vitro research has also found that other proteins which are often co-deposited with amyloid beta, including serum amyloid P component (or SAP) influence the aggregation of amyloid beta and that this property of SAP is enhanced in the presence of aluminium.

The team’s research was used at an inquest for one of the UK’s most notorious water poisoning incidents that occurred in 1988, when twenty tonnes of aluminium sulphate accidently polluted the water supply of the Cornish town of Camelford.

Carole Cross, a Camelford resident, died in 2004 after the onset of congophilic amyloid angiopathy (CAA), a form of Alzheimer’s disease. An autopsy revealed high levels of aluminium in her brain.

Although not conclusive, the coroner at the case reported that there was a “real possibility” that the aluminium in Mrs Cross either caused or contributed to her death.

Other research carried out by Professor Exley has led to the discovery that silicon-rich mineral waters can help to reduce the body burden of aluminium. Research to date has demonstrated that silicic acid is the natural antagonist to aluminium. In research due to be published in the Journal of Alzheimer’s Disease, a silicon-rich mineral water provided by Spritzer Mineral Water Company was used to reduce the body burden of aluminium in individuals with Alzheimer’s disease.
“It’s currently unclear what the impact of this burden of aluminium has on the body and our overall health and wellbeing, which is why we’re interested in exploring the pathology of the metal and to explore the properties of aluminium adjuvants.”
Malaria

Centre for Applied Entomology and Parasitology

Malaria, Mosquitoes and Man: Keele University Research Team targets devastating global disease

Malaria is an important disease that afflicts the health and socioeconomic development of half the world’s population.

In 2005, a global alliance of over 500 governments, non-governmental organisations, commercial companies and private sponsors combined to form the Roll Back Malaria Partnership with the aim to scale-up control measures, ensure their sustained delivery and, by 2015, ensure that malaria is no longer a major cause of global mortality nor a barrier for socioeconomic development. While there has been some successes, these are jeopardised by worrying new reports of treatment failure with the current front-line antimalarial drugs and evolving resistance in mosquitoes to insecticides.

Keele University’s Centre for Applied Entomology and Parasitology hosts a cluster of five research teams that have parallel interests in understanding the pathology of disease and developing strategies for the control of malaria. Termed ‘Malaria, Mosquitoes and Man’ or MMM, this cluster has had some considerable success over recent years in securing external research funding and has developed new research links with colleagues in Western Africa. In addition, MMM recruits and trains scientists, many from malaria endemic countries, in the use of modern molecular techniques. Located within the Huxley Building on the main University campus, MMM is housed within large, modern multi-user laboratories to facilitate sharing of ideas, resources and equipment. Researchers have access to specialist insect-rearing facilities and a secure facility to maintain parasite cultures.

Malaria is a disease caused by a unicellular parasitic organism that is spread between human hosts through the bite of a mosquito. The research carried out by the MMM cluster addresses the biology of the parasite, the pathogenesis of disease in humans and the transmission of the malaria parasite by mosquitoes.

Dr Paul Horrocks and Dr Catherine Merrick are investigating the biology of the most virulent species of the malaria parasite, Plasmodium falciparum. They are interested in the molecular mechanisms that control growth inside human red blood cells, and also in how these infected red blood cells persist in the face of the immune response and how this process can be subverted to cause disease. Both Paul and Catherine are supported by New Investigator Awards from the Biotechnology and Biological Sciences Research Council and Medical Research Council, respectively. Paul also works with Dr Mark Skidmore to explore the potential of chemically-modified complex carbohydrates as a novel adjunct therapy to support more traditional small-molecule antimalarial therapies. Dr Srabasti Chakravorty, meanwhile, focuses directly on the interaction of the malaria parasite with the human host. Parasitized red blood cells can accumulate in blood vessels within the brain, often resulting in coma and death. Srabasti is interested in understanding how this accumulation alters the cells that line the blood vessels and how this then goes on to affect the blood-brain barrier.

The MMM team is also interested in the biology of the mosquito and its complicated interactions with the malaria parasite. They believe that releasing genetically-modified mosquitoes, which kill parasites ingested during a blood meal, may be an effective means of biological control in malaria endemic regions. This creates many challenges; including whether engineered mosquitoes are ‘fit’ enough to persist in the wild and produce a sustained control effect. An important part of this research is collaborations with African scientists.

In one programme, funded by the Wellcome Trust, Professor Paul Eggleston and Dr Frederic Tripet collaborate with researchers at the Malaria Research and Training Centre at the University of Bamako in Mali. As well as training three Malian scientists at Keele, they have established a modern secure research laboratory in Mali to develop and translate these novel control approaches to the ‘field’. In a second capacity-building programme funded by the Medical Research Council, Frederic is working with colleagues in Burkina Faso to seek an understanding of the ecology, population genetics and mating behaviour of local mosquito populations. This information is vital for the future release of genetically-modified or sterile mosquitoes.
“Keele University’s Centre for Applied Entomology and Parasitology hosts a cluster of five research teams that have parallel interests in understanding the pathology of disease and developing strategies for the control of malaria.”
Ages and Stages

Professor Miriam Bernard, Professor Michael Murray, Dr Lucy Munro

Ageing Creatively

Collaboration between academia and the arts supports theatre as a medium for social inclusion

The Ages and Stages project was a collaboration between Keele University and the New Vic Theatre, Newcastle-under-Lyme running from October 2009 to the end of July 2012. The project explored the Victoria Theatre's famous social documentaries – produced between the 1960s and the 1990s – and talked to older people about what part the theatre has played in their lives.

Miriam Bernard, Professor of Social Gerontology at Keele University, led the research team. “The location for this project was the Potteries. This is an area with a long history of heavy industry which has undergone considerable social and economic change and decline over the last forty years. These changes have been charted by many institutions, including the New Vic Theatre, through the pioneering social documentaries developed under its founding Director, the late Peter Cheeseman.”

The research team employed a mixed method approach organised around three interrelated and complementary strands. Strand 1 explored historical representations of ageing through analyses of materials held in the theatre’s archive; Strand 2 focused on recollections and contemporary experiences of ageing through 79 individual/couple qualitative interviews (97 people in total) and ten group interviews (51 people in total) with older people who were/are: (i) sources for the Vic’s social documentaries; (ii) theatre volunteers; (iii) audience members throughout their lives; (iv) actors and theatre employees who continue to live in the area. In addition, participant observation was carried out at the theatre, with current volunteers.

Professor Bernard says: “Our project highlights the importance of challenging stereotypes that creativity declines/ceases in old age; it demonstrate how theatre/drama can be developed as a medium for the inclusion of both older adults and young people; and shows how important participation and volunteering can be at times of transition/bereavement. In Strand 3 of the project, we drew together materials from Strands 1 and 2 to create a new social documentary performance – Our Age, Our Stage – bringing older participants from the project together with members of the New Vic’s Youth Theatre.”

The new social documentary explores ageing, intergenerational relations and the role the theatre has played – and continues to play – in the creative life of the people of Stoke-on-Trent and North Staffordshire. Our Age, Our Stage was performed in a number of local venues in July 2012, including schools, colleges, retirement communities and local councils. Q&A sessions with the cast, crew and research team followed each performance. The main performance took place in the New Vic Theatre, in association with the 2012 British Society of Gerontology (BSG) conference. Audience members included conference attendees, people who were interviewed for Ages and Stages, and invited guests. Alongside this, an ‘Ages and Stages Exhibition’ was displayed at the New Vic Theatre.

Ages and Stages was funded by the national, cross-council New Dynamics of Ageing (NDA) programme, which aims to improve the quality of life of older people through research into all aspects of ageing.
Rising Stars
Discovering Excellence

Dr Claire Fox, Dr Jamie Pringle, Dr Philip Catney, Dr Nicholas Reyland, Dr James Peacock, Dr Ralf Gertisser

Dr Claire Fox
Dr Claire Fox, a Psychologist and former Keele PhD student, has already established herself as a well-known name in the field of bullying in schools. Her involvement in a ground-breaking ESRC-funded study, 'From Boys to Men', which examines the question of how to prevent more boys from becoming perpetrators of domestic violence in later life, led to Claire managing the research stream on a wider EU-funded project, working with six partners across Europe to evaluate domestic abuse prevention programmes and develop new service provision in Malta. Currently, she is leading another high-profile ESRC study, assessing the link between how children use humour and the problem of bullying in schools.

Dr Jamie Pringle
In 2012, Dr Jamie Pringle was the winner of the William Smith Fund, which recognises excellence in applied and economic aspects of Geology. The award was testament to the fact that Jamie is fast becoming one of the UK's leading experts in forensic geophysics, working on a number of studies that will shape the future of forensic science. Most recently, he has led a long-term geophysical monitoring study, which used simulated clandestine burials of murder victims to explore the optimum techniques for forensic search teams. As well as forensics, Jamie works in applied sedimentary research to improve current petroleum reservoir models and is currently undertaking long-term geophysical monitoring studies of geotechnical hazards.

Dr Philip Catney
Dr Philip Catney’s main research interests are in the fields of urban and environmental public policy. Since joining Keele, he has been the lead investigator for two research projects examining the governance and regeneration of cities, as well as a co-investigator for a large ESRC and EPSRC ‘Energy and Communities’ project, examining energy reduction strategies in contrasting communities. He is currently developing research agendas on the politics of urban governance crises. He has presented findings from his work to numerous government departments and organisations, such as HM Treasury, the Environment Agency and the Commission for Architecture and the Built Environment (CABE).

Dr Nicholas Reyland
Dr Nicholas Reyland’s expertise in music, film and narrative theory has seen him invited to speak at some of the world’s most interesting and prestigious music festivals and conferences. In 2013, he will be heavily involved at a major festival by the Philharmonia Orchestra celebrating the 100th anniversary of Witold Lutoslawski, a composer Dr Reyland has become a world authority on.

He is currently working on a study of musical embodiment and hopes to bring an international conference to Keele in 2015 to showcase the results. Embodying the interdisciplinary spirit of Keele research, he is also working with colleagues in the School of Psychology to prepare a report looking at the effects of children’s TV music on behaviour, the results from which will hit the headlines in 2013.

Dr James Peacock
Dr James Peacock is a world-leading scholar of contemporary American fiction having recently received an AHRC Early Career Fellowship for his project called Brooklyn Fictions: the Contemporary Urban Community in a Global Age. He’s already working on his next publication, a collaborative collection of essays on the topic of neurological disorders and trauma-induced psychological problems in literature. In 2013, he will also publish an essay looking at The Clash’s song ‘Red Angel Dragnet’ and how it demonstrates an outsider’s perspective on American inner city issues such as crime, vigilantism and community. As well as stamping his mark on the world of research, Dr Peacock has also received a Teaching Excellence Award for his teaching initiatives, which have now been widely disseminated at Keele and beyond through conference presentations and workshops.

Dr Ralf Gertisser
Dr Ralf Gertisser’s specialist interest in volcanology and igneous petrology has helped to shape his national and international reputation as one of the UK’s leading volcanologists. His research has taken him around the world to explore the formation and life-cycle of magma, volcanic hazards and the climatic impact of volcanic eruptions, and he has already been awarded 15 research grants to support his work, including two prestigious NERC grants. His work as leading researcher on the 2010 eruption in Indonesia saw him step into the media spotlight. He continues to work on some of the most iconic volcanoes in the world, including Tambora, Krakatau and Santorini, demonstrating a breadth and quality of research that is unrivalled in his field.
Helping to address some of the world’s most common health issues, innovations in stem cell therapy at Keele University are offering global solutions for bone tissue growth and repair.

Advanced research and innovation is behind the pioneering work of Professor Alicia El Haj as a new field of medicine – cell therapy – becomes a reality. It is being utilised to assist osteoarthritis and osteoporosis sufferers, as well as tackle heart disease, multiple sclerosis and dementia. Now the research work of Professor El Haj and her team of ‘tissue engineers’ at Keele University is striving to uncover cell therapy techniques that can regenerate major tissue and grow organs – potentially removing the need for challenging reconstructive surgery and minimising the risk, cost and trauma associated with the transplant of donor organs.

Cell therapy development has been rapid over the past 15 years, with work in the USA, which isolated human embryonic stem cells, signalling the unlimited potential of tissue rejuvenation. Currently, stem cells are being used to treat many conditions and it is a collaborative research effort that has taken the subject area forward with universities such as Keele, Nottingham and Loughborough working together to create major centres of regenerative medicine expertise and develop commercially sound practices and processes.

Central to the developments in cell therapy and tissue engineering has been the pioneering research programmes at Keele under the strategic leadership by Professor El Haj. As founding Director for the Institute of Science and Technology in Medicine at Keele University, under her guidance many hundreds of osteoarthritis sufferers have already benefited from cutting-edge cell therapy techniques to treat what is the most common form of joint disease. The basis of the treatment under the clinical leadership of Professor James Richardson, Professor of Orthopaedic Surgery at Robert Jones and Agnes Hunt Orthopaedic Hospital in Oswestry, involves taking cartilage cells from a patient’s healthy knee and culturing them in a laboratory over the course of a number of weeks to grow new knee tissue. The new tissue is then implanted in the damaged joint to replace damaged or worn cartilage. Current activity sees research into the possibilities of mixing cartilage cells with bone marrow stem cells to investigate whether a combination of the two is even more effective.

Steps forward

Looking beyond simple bone or joint repair, Professor El Haj’s techniques have been identified as a route forward to repairing tissue damage on other parts of the body also, and helping to open up opportunities for innovative treatments. Such opportunities include stem cells being injected into the body to repair any tissue or organ; cultured stem cells growing a synthetic liver or kidney or a stem cell bank being established so donated cells could be processed and delivered to a patient on a bespoke basis. The work of the tissue engineers is bringing the day when such wondrous examples of clinical innovation can become a reality.

Crucial breakthrough

The background to Professor El Haj’s work centres upon a breakthrough made some 10 years ago. It involved development alongside Professor Jon Dobson of a novel technique based on magnetic nanoparticles to control how cells communicate with neighbouring cells – an essential component for tissue growth. Investigation began into how magnetic nanoparticles could be used as part of a process to tag them to specific ion channel receptors on a stem cell that receive chemical signals from neighbouring cells. Such signals might, for example, instruct the cell to divide or die, or allow certain molecules to enter or exit.

The crucial discovery made by the team was based on the fact that using a small magnetic field could ‘pull’ the magnetic nanoparticle and open the ion channel receptor and, by doing so, set off the chemical chain reaction that would lead to tissue growth. The breakthrough – which clearly demonstrated that tissue growth could be initiated – countered arguments which cast doubt on it being possible.
Ongoing development

Professor El Haj’s team has gone on to demonstrate that the technique could be applied to a three-dimensional structure to grow tissue and maybe other artificial organs. There were inherent problems associated with the use of mechanical forces as part of the lab’s tissue growth chambers known as ‘bioreactors’. Keele’s team managed to prove that by using alternative magnetic forces instead of crushing mechanical loads to stimulate tissue growth across a range of biomaterials, the technology could be successfully applied to many soft, biocompatible and biodegradable materials.

With the bioreactors successfully proven to grow tissue, the next challenge is to test the possibility of growing tissue in vivo or within the body itself. Already undertaken successfully on mice – an experiment which saw stem cell differentiation and bone tissue growth enabled remotely – the possibilities for the human race are limitless.

If the in vivo process can be repeated in humans, the research team may have uncovered a method to treat common ailments and chronic diseases such as arthritis without the requirement for major surgery, artificial or even donor organs. Indeed, a new technique is underway to hopefully one day establish the possibility of doctors repairing damaged bones and joints anywhere in the body by simply injecting stem cells into a patient’s arm. With the theory established, it is hoped to move to human trials within the next five years.

The use of magnetic nanoparticles opens the door to many applications, ranging from dynamic drug screening, which would allow the pharmaceutical industry to mimic the complex cell behaviours that occur in the body as part of new drug developments, to the possible use of the technique as a much more localised anaesthesia method.

The future

Future questions centre around the possibilities of ‘switching on’ stem cells already present in patients’ joints, as well as potential therapies that could see publically donated cells being utilised. The future existence of a universal donor cell bank that could be grown and processed for delivery to a patient as and when required is now carrying increased credibility.

Cell therapy is an exciting new field of medical discovery and is gaining rapid momentum. Thanks to the revolutionary work of Professor El Haj and her team of tissue engineers at Keele University, it is set to play an increasingly important role in meeting some of the key healthcare challenges of the future.

“Central to the developments in cell therapy and tissue engineering has been the pioneering research.”
Sustainable Communities

Professor Andrew Dobson
Reducing Energy Consumption through Community Knowledge Networks (RECKKN)

The ‘clean’ generation and use of energy is one of the biggest challenges facing us, yet, while tackling energy issues at an individual level is important, less is known about the potential for community-level initiatives as a context for sustainable patterns of consumption to drive positive change.

An interdisciplinary team at Keele is using a case study methodology to conduct focused or paired comparisons of two communities, in Newcastle-under-Lyme and Shrewsbury respectively, with different socioeconomic profiles. The aim is to explore ‘knowledge networks’ in these communities: the ways in which information about energy is shared between people and organisations. It is expected that the differences between Newcastle-under-Lyme and Shrewsbury will generate a range of contrasting insights for understanding how energy-relevant knowledge circulates within different communities.

Principal Investigator Professor Andrew Dobson, Research Institute for Social Sciences, said: “The evidence is that top-down, information-led approaches to changing people’s energy-related behaviour doesn’t work very well. Our research suggests that people already have quite a bit of knowledge regarding energy use, and it is important to take this into account when designing interventions so that these interventions are ‘embedded’ in real contexts. We also want to find out how much people share energy-related knowledge, and this is what we hope to discover from our 60 household-level interviews.

Once we have a clearer idea of how energy circulates between households – and why sometimes it does not – we will be in a position to make policy recommendations in respect of community-level interventions.”

Reducing Energy Consumption through Community Knowledge Networks (RECKKN) is one of seven interdisciplinary projects funded by the Engineering and Physical Sciences Research Council (EPSRC) under their Energy and Communities collaborative venture. It is worth £0.5m and runs until 2013. The RECKKN team comprises Sarah Marie Hall, Sarah Hards (Research Associates), Andrew Dobson, Philip Catney, Sherilyn MacGregor (Research Institute for Social Sciences), Mark Ormerod, Zoe Robinson (Environment, Physical Sciences and Applied Mathematics Research Institute), and Simon Ross (Marches Energy Agency).

The project’s website can be found here: [www.esci.keele.ac.uk/recckn](http://www.esci.keele.ac.uk/recckn)

The questions they want to answer are:

- Does knowledge about energy consumption and reduction travel within community networks?
- What are the roles of different actors/organisations/channels in disseminating this knowledge?
- What are the barriers to energy-saving?
- What forms of knowledge exist about energy? How can these help or hinder efforts to reduce energy consumption?
- How do energy consumption and knowledge networks vary between different communities?
- What lessons can we learn for policy and practice?

By investigating knowledge networks, they are moving away from the idea that information provision in a top-down direction is what is needed to make people ‘change their behaviour’. The team recognises that people already possess tacit knowledge about energy practices in everyday life, and that if new knowledge about energy use is to be injected into people’s lives, it will have to be done using existing networks that they trust and that are grounded in their own contexts.

Professor Dobson added: “Our research will enable us to draw conclusions regarding the differences in energy knowledge and its circulation in deprived and relatively well-off communities. Fuel poverty is on the increase, so exhortations to ‘use less energy’, when many people feel that they don’t have access to enough, are unhelpful. We hope that our research will give us important data regarding the sources of energy knowledge in these different types of community, and this should result in more fine-grained and context-led energy interventions.”
Music

Professor Rajmil Fischman
Cyber Soirees – bridging popular and art culture

Rajmil Fischman, Professor of Composition in Keele’s Research Institute for the Humanities, is looking to take musical composition to a new level with his work that aims to enable music performance by using natural hand actions.

It will implement a self-contained ‘Manual Actions Expressive System’ (MAES) consisting of a digital glove controlled by specialised software for the creation of musical gestures – furthering the possibilities afforded by game controllers.

While these gestures result from tracking and analysing hand position, rotation and finger bend, the technology will allow performers to concentrate on natural actions from daily use of the hands, for example the physical movement associated with ‘throwing’ and ‘sowing’.

For this reason, MAES will not require formal musical training, producing sophisticated sound that is a believable result of the performer’s natural actions and providing intimate control of the sound.

Professor Fischman, whose work is funded by the Arts and Humanities Research Council, said: “This will allow individuals who would not have had the opportunity otherwise, to engage actively in music making. At the same time, it will enable performers to achieve virtuosity by providing gestures that can be adapted to individual requirements.”

MAES will complete the first stage of an overarching strategy for the realisation of ‘Structured interactive immersive musical experiences’, in which users advance at their own pace in a virtual environment stimulating all the senses (hearing, sight, smell, etc.) and choose their own trajectory through a musical work, but have to act within its interactive rules and constraints towards a final goal – the realisation of the music.

Professor Fischman adds: “Imagine a weekend afternoon in a middle-class parlour during the second half of the nineteenth century. If we could travel in time to that period, it is quite likely that we might have found ourselves in a soiree including music performed live by family members gathered around the piano or other instruments, re-enactments of theatrical plays and role-playing games. Such gatherings used to foster creative social interaction which has now become increasingly rare. “Hopefully, research into immersive and interactive musical activity will retrieve new forms of social gatherings in both real and virtual ‘parlours’. We already see new paradigms encouraging communal activity in social networking sites and I believe that, given appropriate tools and conditions, this is also possible in the case of music creation and performance, be it at home or in ‘cyber-soirees’.

“I also believe that it will help breach the schism between so-called ‘popular’ and ‘art’ culture, which became so stark in the twentieth century before it was challenged by post-modernism. In fact, electronic media already encompasses a wide range of creative output that happens to defy popular/art dichotomies. “We can now conceive performers in the modern parlour who use appropriate technologies to embrace music resulting from a wide spectrum of aesthetic conceptions and approaches, even if they do not have formal musical training: for instance, in the case of a video game generation that prefers total immersion and interactivity. I am convinced that existing compositional knowledge and current technology make this possible today. The problem now is one of content and this is precisely the role of music creators focusing on the realisation of an idiomatic, expressive, novel and musically interesting repertoire by means of the adaptation of present technologies.”
“Research into immersive and interactive musical activity will retrieve new forms of social gatherings in both real and virtual ‘parlours’.”
Key back pain trial paves the way for improved patient outcomes

A new primary care approach to dealing with musculoskeletal pain called “stratified care” – which identifies the right treatment according to a person’s need, and ensures treatment is provided in the right place and by the most appropriate health professional – is one of the key outcomes from the pioneering research work taking place at the award-winning Arthritis Research UK Primary Care Centre of Excellence based at Keele University. The ‘STarT Back trial’ has resulted in significant improvements in patients’ pain and function – as well as significant cost-savings for the NHS.

An estimated 20% of UK adults consult their general practitioner (GP) each year with a musculoskeletal problem, accounting for 1 in 6 GP consultations, 8.8 million physiotherapy consultations, and over 3.5 million calls to emergency services. Musculoskeletal problems represent the single largest group of chronic conditions for which patients consult their GPs. Osteoarthritis is the most common reason for loss of function and disability among older people, while back pain is the commonest reason for sickness absence and work loss among younger people.

Keele’s Institute of Primary Care and Health Sciences hosts the Arthritis Research UK Primary Care Centre of Excellence. It delivers a world-leading research programme which highlights the importance of musculoskeletal conditions to individuals and to society by demonstrating the extent of musculoskeletal pain in the population, the extent to which such conditions cause increasing health and social care burden and costs, and the impact which pain has on individuals through loss of function and increasing disability.

The work involves researching ways of preventing musculoskeletal conditions from starting, getting worse, or limiting people in their daily lives and activity; developing new approaches to self-management and treatment of these conditions by GPs and physiotherapists in particular, and shifting the perception that musculoskeletal conditions are an inevitable consequence of growing old by taking a more positive approach where the symptoms of pain and disability can be addressed more directly.

The Centre of Excellence is one of only eight members of the National Institute of Health Research (NIHR) National School of Primary Care Research and has over £35 million in current grant income, from prestigious funders such as the National Institute of Health Research, the Medical Research Council, Arthritis Research UK and the Wellcome Trust. The centre also trains the primary care researchers of the future. Over 20 of the Centre’s staff hold prestigious, externally-funded Research Fellowships, from doctoral, to post-doctoral to professor levels.

Rhian Hughes, deputy director at the centre, summarises the aims of the research programme in this important area. “Our mission is to identify ways to reduce chronic musculoskeletal pain in individuals and the population. We are trying to achieve this by understanding the causes, course and consequences of musculoskeletal pain; identifying the best ways in which GPs and physiotherapists can assess, prevent and treat patients; improve the content and delivery of primary care in order to optimise outcomes for patients with pain and musculoskeletal conditions and then disseminate our research in a way that raises awareness and understanding of arthritis and its consequences amongst patients, health practitioners and policy makers.”
Research impact
The ‘STarT Back trial’ was the culmination of 10 years’ research activity. The Centre developed a core set of simple questions which can be used by GPs or physiotherapists during a routine consultation. The answer which back pain patients give to these questions then groups them into those at low, medium or high-risk of experiencing persistent and disabling back pain.

New treatment approaches are then specifically targeted to these groups. A simple package of advice, exercise and short-term pain medication is used for the low-risk group, more intensive physiotherapy is prescribed for the medium risk group and intensive physiotherapy plus structured approaches to managing and coping with pain, based on psychological treatments such as cognitive behavioural therapy (CBT), is recommended for the high-risk group.

Professor Elaine Hay, the Chief Investigator in the STarT Back trial, and Director of the Research Centre concludes: “When we tested the screening and targeted treatment approach in real-life general practice and physiotherapy, we found significant improvements in patients’ pain, function and patient satisfaction – alongside significant cost-savings both for the NHS and society.”

The STarT Back Screening Tool and the targeted treatment approaches are available online (www.keele.ac.uk/startback) and the new approach is being rapidly integrated into Back Pain Treatment Guidelines nationally and internationally.

In RAE 2008, over 80% of the Centre’s research was judged to be of international quality and it is ranked the 5th best primary care research unit in the country.

In 2009, the Centre was awarded the Queen’s Anniversary Prize for Further and Higher Education, for pioneering early intervention and primary care in the management of chronic pain.

“Our mission is to identify ways to reduce chronic musculoskeletal pain in individuals and the population.”
Living with HIV in later life

Dr Dana Rosenfeld

New study will inform future interventions designed to improve the social support, mental health and quality of life of older people living with HIV

Thanks to effective medication introduced in the late 1990s, HIV, or the Human Immunodeficiency Virus, has changed from an acute, fatal condition to a chronic, manageable one, with many people with HIV now surviving into later years.

A new Keele study is exploring the lives of older people living with HIV. This wide-ranging study entitled HIV and Later Life, or HALL, aims to inform new interventions designed to improve the social support, mental health and quality of life of this growing yet often unrecognised group.

Dr Dana Rosenfeld, from Keele University’s Centre for Social Gerontology, whose earlier research has explored lesbian and gay ageing and the long-term effects of the AIDS epidemic on gay male communities, is leading this new study. Drawing on Dr Rosenfeld’s background in medical sociology, social gerontology, and gender and sexuality, and with the help of an interdisciplinary research team representing the social sciences, medicine, psychology, psychiatry, epidemiology, and the HIV community, this innovative collaboration will explore the life histories, mental health, social support and quality of life of older people with HIV, along with their experience and management of personal, medical and social dimensions of HIV.

Dr Rosenfeld explains, “Previous research shows that older people living with HIV are more likely to experience depression, illness and mortality than HIV-negative people. What’s more, unlike the HIV-negative older population, depression rates of those living with HIV in later life do not decrease with age, which could be down to their smaller and more fragile social support networks. Yet despite growing academic and medical interest in ageing with HIV, little is known about how these older people’s different histories and circumstances shape how they experience and manage the social and medical implications of HIV in later life, and how their social resources and actions relate to mental health and quality of life.”

To capture these connections, the team is conducting interviews with representatives from key groups including clinicians, policy makers and HIV activists and service providers, and 6 focus groups and 90 life-history interviews with older gay men, and with older Black African and white heterosexual men and women, living with HIV, all recruited through clinics and community organisations in London. The team will also gather mental health survey data, and compare them with interview data to see how these older persons’ social support systems relate to their mental health. Results will be disseminated through academic and scientific venues, uploaded onto the project’s website (www.keele.ac.uk/hall), and presented to the HIV community at an end-of-project conference in July 2013.

The project, ending in October 2013, is funded with £211,316 over two years by the Lifelong Health and Wellbeing Cross-Council Programme led by the Medical Research Council and the Economic and Social Research Council.

The Lifelong Health and Wellbeing (LLHW) initiative is a funding collaboration between the UK’s research councils and health departments. LLHW funds multidisciplinary research to find out more about what influences health and ageing throughout life. The Medical Research Council manages the LLHW initiative on behalf of the funders.

For more information see www.mrc.ac.uk/LLHW
“Previous research shows that older people living with HIV are more likely to experience depression, illness and mortality than HIV-negative people.”
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