

# Cleaning up our Precious Water



Precious freshwater systems are being polluted every day by the metals discharged by active and abandoned mines. A team of Civil Engineering experts at Newcastle University is helping to tackle this global problem.

The expertise of the Newcastle team, led by Dr Adam Jarvis and Dr Jaime Amezcaga, has shaped international guidelines on mining pollution management as well as policy and practice at a national and regional level.

Already the daily practice of thousands of professionals worldwide is informed by the research, which has helped shape the Global Acid Rock Drainage Guide. An initiative of the world's major mining houses, this is the first comprehensive international document on mining pollution management.

The value of the work came to the fore during one of Peru's most high profile mining conflicts at Tintaya mine in Espinar, which centred around issues of alleged pollution

and its impact on the local environment. The Newcastle University team was called upon by the Catholic Agency for Overseas Development to provide policy advice and technical support to help bring about a resolution to the dispute.

Currently, they are trialling a system to remove metal from water without the need for energy or chemicals.

The 'vertical flow pond', in the heart of the Lake District National Park, will be the UK's first fully-operational, large-scale passive mine water treatment scheme. Designed by the Newcastle team, working with the Coal Authority, National Trust and Environment Agency, and funded by the Department for Environment, Food and Rural Affairs,

it uses compost and limestone to treat metal-rich mine water. It is being constructed at the site of the former waste lagoons at Force Crag mine outside Keswick.

Construction on the project began in September 2013 and the ponds will be up and running by early 2014. The aim is to test the effectiveness of the technology on a large scale. If successful the method could pave the way for cleaning up hundreds of abandoned metal mines across England and potentially across the world.

[adam.jarvis@ncl.ac.uk](mailto:adam.jarvis@ncl.ac.uk)

# Making Light of heavy Oil



Research by a team of geochemists and microbiologists at Newcastle University, led by Professors Ian Head and Steve Larter, is opening up untapped oil reserves. Ian Head explains.

The majority of the world's petroleum deposits are made up of heavy crude oil, which is highly viscous and cannot easily flow to production wells under normal reservoir conditions making it difficult and costly to extract and refine. It is generally considered to be a less valuable resource than light oil, which flows freely at room temperature, and produces a higher percentage of gasoline and diesel fuel when converted into products by an oil refinery.

Heavy oil is formed by the biodegradation of crude oil in petroleum reservoirs, but until recently, little was understood about the process. The breakthrough in our research came when we established that in-reservoir biodegradation is actually an anaerobic process driven by water-hydrocarbon reactions at an oil-water contact zone, rather than one driven by oxygen delivered in meteoric waters, as was previously believed.

Our findings have overturned decades of conventional wisdom in the oil industry, and have had significant practical implications for oil production, including a whole new approach to the placement of oil wells. As a result, oil companies are more readily able to identify and target areas of lower viscosity in biodegraded oil fields, leading to improved production from heavy oil reservoirs.

The impact of this research on the oil industry and related companies has been far-reaching. Using fundamental insights, models and software tools that the research generated, companies can now more accurately identify areas of greatest potential in biodegraded oil fields.

Our research led to the launch of a spin out company, Gushor Inc, by our collaborators in the University of Calgary. Gushor was recently acquired by Schlumberger, which provides services to the heavy oil sector.

We are currently exploring ways to harness the microbial processes that led to heavy oil formation over geological timescales.

Even the most advanced extraction processes can leave as much as 60% of oil trapped in reservoirs. By manipulating these natural processes, we hope to be able to recover the energy from this left over heavy oil and residual oil by converting it to methane gas.

Methane is more readily recovered and has the added advantage that electricity generation from methane produces about one third less CO<sub>2</sub> per kWh than oil itself. This could be an important route to lower – though clearly not zero – emission fossil energy. Such strategies will be important bridges from our current fossil fuel based energy economy to a future when sustainable energy generation from a range of sources becomes a reality.

[ian.head@ncl.ac.uk](mailto:ian.head@ncl.ac.uk)



# The Impact of a World-Class Civic University

Life after liver disease

Cleaning up our precious water

Tackling dementia

Making light of heavy oil

Educating to extremes

# International Outlook



by Vice-Chancellor  
Professor Chris Brink  
chris.brink@ncl.ac.uk

Newcastle University is ambitious on a global scale. The quality of our research and teaching underpins that ambition.

Our campuses in Singapore and Malaysia, and the strategic partnerships we have forged with institutions in China, Brazil, Angola and Indonesia among others, are helping us to establish a presence around the world. Our commitment to tackling the big societal issues of the day is clear in our research, including projects addressing challenges such as water supply, human trafficking and cancer treatment and others featured in this document. Our students receive the highest quality teaching in campus facilities which have had huge investment in recent years. Our graduates are among the most highly employable in the United Kingdom.

As the examples in these pages show, Newcastle's vision of itself as a world-class civic university is more than a simple positioning device. It is based upon principles that can be found throughout our research and teaching.

To learn more about the international impact of our research, visit [www.ncl.ac.uk/impact](http://www.ncl.ac.uk/impact)

**In 2011, Newcastle became the first UK university to establish a medical campus overseas. Later this year, the first cohort of 20 medical students will graduate from the University's medical school in Johor, Malaysia, to embark on new careers in the country's health service. This important milestone is a tangible demonstration of Newcastle University's commitment to working with international partners to invest in collaborative teaching and research projects.**

## Malaysia

The origins of medical education at Newcastle, in the North East of England, can be dated back to 1834 when a School of Medicine and Surgery was first established in the city.

Since that time, Newcastle has been at the forefront of major advances in the understanding and treatment of medical conditions which continue to blight humankind, with work in areas such as diabetes, Alzheimer's disease and cancer establishing Newcastle as a world leader.

The opening of an international branch campus for medicine and biomedical sciences – Newcastle University Medicine Malaysia (NUMed) – saw the beginning of a new chapter in Newcastle's medical history.

Subject to final accreditation by the General Medical Council (GMC), the junior doctors now graduating from NUMed will hold a UK Primary Medical Qualification, making them eligible for provisional registration with both the GMC and the Malaysian Medical Council.

## Singapore

Newcastle University has been a destination of choice for Singaporean students for decades. Building on

this, and strong links with Ngee Ann and Nanyang Polytechnics, in 2009 the University joined forces with SIT, the Singapore Institute of Technology, to launch Newcastle University International Singapore (NUIS).

Since its establishment, more than 1,350 students have attended NUIS, studying one of seven academic programmes in subject areas across a range of engineering disciplines and food sciences. In 2014, NUIS will move its operation into two of five purpose-built new campuses being developed by SIT, providing a state-of-the-art learning environment for students.

Driven by a commitment to providing highly-skilled graduates to support Singapore's industry and economy, NUIS has established strong research partnerships with industry leaders from the food, marine and electronics sectors.

A number of Centres of Excellence designed to align the University's research expertise with Singapore's strategic ambitions in areas including science, health, computing, the maritime industry and engineering, will be created in the coming years.

## China

To further its developments in China, in 2012 Newcastle University entered into a Strategic Partnership with Xiamen University to foster academic, cultural and social relationships between the North East of England and South East China. The first outcome of the partnership was the launch of a Confucius Institute in Newcastle in May 2013.

This partnership represents a significant commitment on the part of both institutions to collaborate across a wide range of research, teaching and cultural activities. These include: energy; cultural and creative industries; ocean science; and public health.

The collaboration will also lead to new teaching programmes that are relevant to global needs. Agreement has already been reached to establish the first of these, an International Management Programme, to be offered jointly between the two Business Schools in Xiamen and Newcastle.



## Transnational teaching initiatives

An inspirational new partnership between Newcastle University, the Planet Earth Institute, the Angolan government, UNESCO and the Banco Espírito Santo Angola is supporting the training of a new generation of environmental scientists in sub-Saharan Africa.

The Centre of Excellence in Science for Sustainability in Africa has been established to promote teaching and research in key areas such as sustainable agriculture, sociology, environmental studies, and natural resource management. The first PhD students will be enrolled later this year, with the ultimate goal of training 100 PhD students over the next 10 years.

The Newcastle-Indonesia Doctoral Training Centre is the latest stage in a collaboration between Newcastle and Universitas Indonesia spanning more than 20 years. Based in Newcastle's Faculty of Medical Sciences, the Centre aims to provide up to 40 trainee doctors a year from Indonesia with the skills needed to conduct biomedical research to support Indonesia's health service.

The establishment of the Loyola Study Abroad Center at Newcastle University in 2012 is helping to build links in North America. Loyola is one of the largest providers of study abroad programmes in the US, and Newcastle is its only UK partner. Initially set up to accommodate around 50 study abroad students, this number has almost doubled in the space of two years.

The massive increase in the need for highly skilled, forward-thinking graduates being generated by Brazil's diversifying and expanding economy has prompted the country's government to look overseas to help meet the demand for university places. Newcastle University is one of the key UK destinations for students on the Science without Borders programme, introduced to support the development of Brazil's HE sector and their scientific research base through international exchange. The programme has identified a number of priority areas, including health and biomedical sciences, renewable energy, marine sciences, computing and IT, engineering and technology.



# Powering Smart Grids of the future

**Smart Grids and energy storage have the potential to revolutionise power networks by maximising the efficiency, availability and sustainability of energy.**

Experts in energy from Newcastle University are leading the UK's largest £54 million Smart Grid project, and at Science Central – Newcastle's major new city centre science and technology site – they are developing a test bed that could pave the way for the future of energy storage.

Where 20th century power meets 21st century technology, the new grid scale storage demonstrator will be the first of its kind in the UK and will be integrated with a full scale Smart Grid on the site.

Leading the research is Professor Phil Taylor, (pictured right) Director of the Newcastle Institute for Research on Sustainability at Newcastle University. He explains: "In the past, electrical networks were operated in a passive manner, electricity flowing from high voltage networks down towards the customer at low voltages.

"But as low carbon technologies have come along all that has changed. Distributed generation such as wind farms right down to heat pumps and solar panels means power is now flowing in both directions and in a relatively unpredictable way. We need to find a way of managing that power in real time such that the low carbon transition can be achieved at reasonable cost and without degrading power system reliability.

"That's why a smart grid system is so important. We need to match supply to demand in real time and within network constraints and that means making the grid more intelligent.

This intelligence allows demand response, the involvement of customers, and energy storage to be integrated into existing networks.

"Newcastle University's expertise in power systems, power electronics, renewable energy and sustainable infrastructure and our close links with key industry partners means we are well-placed to play a role in this important and exciting research project."

The Engineering and Physical Sciences Research Council has awarded a further £15 million for Smart Grid research and Newcastle University, together with Siemens and Northern Powergrid, are key players in this new project.

[phil.taylor@ncl.ac.uk](mailto:phil.taylor@ncl.ac.uk)



# Fighting Back

**Pioneering research by geographers and sociologists at Newcastle University is helping women and children in Nepal put the horrors of human trafficking behind them. Dr Meena Poudel, former Director of Oxfam in Nepal and an alumna of Newcastle University, was so inspired by the work of Professors Nina Laurie and Diane Richardson, and Dr Janet Townsend, that she decided to assist by offering her expertise. She explained what the team has achieved to date.**

When 148 Nepalese girls and women were rescued from trafficking in a police raid on an Indian brothel in 1996, it would have been easy to assume their fortunes were about to change.

However, this was just the start of a traumatic new chapter in their lives, which saw them stigmatised, labelled as prostitutes and HIV carriers and locked away in remand homes in India where conditions were as bad as, if not worse than, prison. On return to their homeland they struggled to regain self-esteem, social acceptance and even basic human rights. Rejected by their families and communities, they were left believing they were to blame for being trafficked.

The beginning of this story is all too familiar to survivors of human trafficking, who often face extreme challenges in accessing citizenship and establishing new livelihoods after escaping their ordeal – and whose voices, until now, have not been heard. But this particular group of women from Nepal – aged just 15 to 18 years – have fought back, setting up the first ever non-governmental organisation to be founded by survivors of trafficking, which they boldly named Shakti Samuha – or Power Group.

Newcastle University's major research project, funded by the Economic and Social Research Council and carried out in partnership with the women of Shakti Samuha and the International Organisation for Migration Mission in Nepal, was one of the first in the world to systematically

analyse women's experiences after they have been trafficked. Most work in this field addresses the causes and characteristics of trafficking to help rescue victims, so the next phase of their victimisation is often overlooked. The Newcastle team works with the survivors themselves, helping women build new lives and changing public perceptions about survivors of trafficking.

"Our project has been a co-production from the beginning", says Dr Poudel. "From our first meeting with Shakti Samuha, they told us they wanted to be the authors of their own stories, and our role was to guide them through the process and show them how to carry out their own research to bring about change."

New democratic processes, supported by national and transnational communities, are unfolding in Nepal. Anti-trafficking advocacy is highly visible and, through the country's new Constituent Assembly, there are fresh debates about returnee trafficked women. By bringing this issue into the spotlight the project is helping to generate a new research and policy paradigm for understanding the relationship between sexuality, gender and development.

The project has been instrumental in the creation of the Human Trafficking and Transportation Control Act, part of the Interim Constitution of Nepal, 2007 which is designed to protect the rights of women returned from trafficking and to prevent them from being exploited.

Shakti Samuha is now represented on the National



Committee in Controlling Human Trafficking and the group is lobbying to revise citizenship laws so that survivors and their children no longer need to get the permission of a father or husband to be recognised as a citizen. Currently, without this permission basic services and schooling are denied.

The women of Shakti Samuha are a constant source of inspiration. In 2013, they received the Ramon Magsaysay Award for their work. Asia's highest honour, it is widely regarded as the region's equivalent to the Nobel Prize.

"These women have such incredible spirit and determination to create new lives after suffering horrendous experiences that most of us cannot even comprehend. We are proud to be playing a part in helping them to explore the opportunities they so richly deserve", says Dr Poudel.

**Dr Meena Poudel now works for the International Organisation for Migration as Policy and Programme Advisor.**

[diane.richardson@ncl.ac.uk](mailto:diane.richardson@ncl.ac.uk)

**A cultural development programme that has grown out of research by Dr Nanette de Jong, of Newcastle University's International Centre for Music Studies, is contributing to the fight against poverty, HIV/AIDS and gender inequality in Southern Africa by strengthening the region's cultural sector.**

Southern Africans' diverse and dynamic cultural heritage is one of their richest resources, with the potential to generate significant economic and social benefits. Nanette de Jong's study, carried out during a two-year Fulbright fellowship in South Africa, demonstrated the importance of the role cultural practices can play in empowering marginalised communities. But the study also exposed the lack of a formal cultural sector in Southern Africa that was limiting women's and young people's opportunities.

The Southern African Cultural Leadership (SACL) emerged from Dr de Jong's research as a way to broaden the range of cultural activities available to these groups by providing training and employment programmes and leadership workshops. Since its inception in 2012, SACL has established 19 training programmes in South Africa and Zimbabwe, helping prepare some 750 women and young people for employment within the cultural sector.

SACL is also helping to break down barriers between traditional healers and western medical practitioners. Their work has led to improvements in the safety and regulation of male circumcision rituals and better community care for children left without home or family in townships ravaged by HIV/AIDS-related deaths.

In 2012, SACL organised a Leadership Conference that brought African Chiefs together with traditional healers and western doctors for the first time to share their knowledge of HIV/AIDS. At the conference, Dr de Jong and King Madzikane, leader of the Eastern Cape KwaBhaca Kingdom, presented a study on Umkhosi Wokuhahlela – a ritual celebrating virginity that has been resurrected as a strategy for fighting HIV/AIDS.

"This is just one example of how we are helping South African and Zimbabwean stakeholders to undertake research that serves their own needs", says Dr de Jong.

[nanette.de-jong@ncl.ac.uk](mailto:nanette.de-jong@ncl.ac.uk)

## Power of Arts & Culture



# Educating to Extremes

**Schooling in some of the world's poorest and hardest to reach places has been dramatically improved as a result of research led by Professor James Tooley and Dr Pauline Dixon (pictured right) of Newcastle University's E G West Centre.**

Something extraordinary is happening in Africa and Asia. Instead of sending their children to government schools, poor families are choosing to pay for low-cost private schools.

Prior to Tooley and Dixon's research, such schools were virtually unheard of in terms of making a positive contribution to 'education for all'. But their research has altered this dramatically, changing awareness, attitudes and policies among international agencies such as the Department for International Development and national governments, leading to massive investment in 20 countries across five continents.

Initially focused on the slums and shantytowns of Ghana, Nigeria, Kenya, India and China, Tooley and Dixon's research culminated in 2013 with a focus on the world's most difficult regions: the conflict-torn African states of Liberia, Sierra Leone and South Sudan.

Tooley explains: "The findings were remarkable. In urban

areas, the vast majority of schoolchildren were found to be in low-cost private schools, while in rural areas, only a minority were being educated in this way.

"Tests and questionnaires among 35,000 children revealed that the choices made by poorer parents made sense. Low-cost private schools were outperforming government schools in core subjects."

From a 15-minute film for BBC Newsnight in the UK to an American full-length film and an Indian best-selling book, the communication of the findings has been critical in inspiring investors, philanthropists and donors alike.

Among the initiatives inspired by the research are a voucher programme in Pakistan which enabled hundreds of thousands of girls from poor families to attend low-fee private schools, and the £300 million Girls' Education Challenge Fund, which seeks to stimulate non-state providers to get up to one million girls into schools in the hardest-to-reach places. Not-for-profit organisations



have already contributed \$350 million to the scheme as a direct result of Newcastle's research and more is expected to follow as the momentum created by Tooley and Dixon continues to build.

**"Prof Tooley directly inspired my life's work. As a result, I believe that, over the next 20 years, 20 million impoverished children will have received a much better education than otherwise would have been possible."**

**Chris Crane**, President and CEO of Edify USA, a micro finance organisation that has provided significant investment for low-cost schooling.

[james.tooley@ncl.ac.uk](mailto:james.tooley@ncl.ac.uk)

[pauline.dixon@ncl.ac.uk](mailto:pauline.dixon@ncl.ac.uk)

# Championing Rural Resilience

**Research into rural economies and societies at Newcastle University has been recognised with a Queen's Anniversary Prize for Higher and Further Education. Guy Garrod, Director of the Centre for Rural Economy (CRE), explains its work.**



CRE was founded in 1992 under the inspiring leadership of Professor Philip Lowe. For the past 21 years, CRE has led studies of some of the world's most pressing challenges, from how we use land and natural resources, to the changing relationships between rural and urban communities and how we tackle rural social exclusion.

Rural issues are still of the utmost importance, as recent public debates on badger culls, healthy and sustainable food production, affordable housing and rural broadband show. It is vital that these debates are evidence-led, and the Centre for Rural Economy is committed to developing the knowledge and insight to ensure this is the case, working closely with rural communities and businesses so

that our research is as grounded and useful as possible. Our work has also helped to update the picture of rural economies and societies, changing the image of the 'rural' away from something outdated and marginal to places which have their own rich sources of dynamism and extend far beyond agricultural development.

CRE's research has also been reflected in the policy shift from farm subsidies and regulation towards investment in the capacity of people, businesses and places for sustainable development – a stance that has influenced policy thinking in Europe, Japan and Korea among others. In addition, the Northern Rural Network, established by CRE to foster rural development in the North of England,

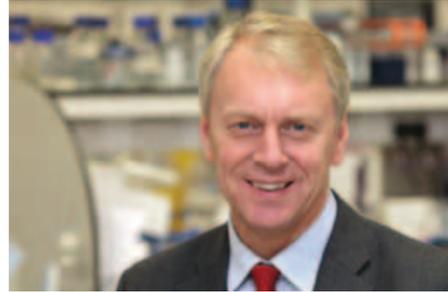
has been taken as a model for engagement between academia and business in the US.

Over the course of the next 21 years, we aim to build upon our successes by continuing to explore key themes affecting rural economies and societies, including rural resilience to economic crises, food security issues and democratic and participative models of rural development.

[guy.garrod@ncl.ac.uk](mailto:guy.garrod@ncl.ac.uk)

# Life after liver disease

The internationally recognised clinical trial work of Newcastle University's team of hepatologists is focused on prolonging life and improving quality of life for patients with liver disease. Recent advances by the Liver Research Group, published in *Hepatology* and the *Journal of Hepatology*, among others include the establishment of a new diagnostic technique for a form of liver disease that is rapidly becoming commonplace in the Western world. The group has also contributed to the discovery of a gene mutation for excessive alcohol drinking.



In the developed world, up to one in four people suffers from non-alcoholic fatty liver disease (NAFLD), a condition closely associated with obesity that, in its early stages, causes scarring on the liver, known as fibrosis. At an advanced stage it can progress to cirrhosis, liver failure and cancer, as well as heart disease.

Until the breakthrough by Newcastle University, the only accurate way to determine the amount of scarring caused by NAFLD was by liver biopsy, an expensive, invasive and sometimes painful procedure that can be unreliable and has occasionally been associated with the death of some patients.

Working with colleagues from the USA, Europe and Australia, studies led by Professor Chris Day at Newcastle University have established a safe and reliable non-invasive alternative to a biopsy – the NAFLD Fibrosis Score – which is capable of accurately differentiating patients with and without fibrosis.

The diagnostic, which has now been incorporated into two sets of international guidelines, allows biopsy to be avoided in 75% of patients, and has the potential to save the National Health Service £2 million annually.

[chris.day@ncl.ac.uk](mailto:chris.day@ncl.ac.uk)

A Newcastle University researcher is the joint author of an exciting study reporting the discovery of a gene responsible for regulating alcohol consumption which, when faulty, can cause excessive drinking. The study, which was peer reviewed in the journal *Nature Communications*, also identified the mechanism underlying this phenomenon.

The research, the work of a consortium of five universities, showed that normal mice show no interest in alcohol and drink little or no alcohol when offered a free choice between a bottle of water and a bottle of diluted alcohol. However, mice with a genetic mutation to the gene *Gabrb1* overwhelmingly preferred drinking alcohol over water, choosing to consume almost 85% of their daily fluid as drinks containing alcohol.

Dr Quentin Anstee, Consultant Hepatologist at Newcastle University said: "It's amazing to think that a small change in the code for just one gene can have such profound effects on complex behaviours like alcohol consumption.

**"We are continuing our work to establish whether the gene has a similar influence in humans, though we know that in people alcoholism is much more complicated as environmental factors come into play. But there is the real potential for this to guide development of better treatments for alcoholism in the future."**

[quentin.anstee@ncl.ac.uk](mailto:quentin.anstee@ncl.ac.uk)

# Pioneering 'Smart' Drugs

For more than 20 years, Newcastle University has been at the forefront of the global battle against cancer, leading breakthroughs in the development of 'smart' drugs known as PARP inhibitors. Nicola Curtin, Professor of Experimental Therapeutics, explains.

The potential of PARP inhibitors to treat cancer has long been championed by my team at Newcastle University but in the early days of our project not everyone agreed. It wasn't until they were found to target cancer-specific weaknesses, by selectively killing breast and ovarian cancers caused by mutations in a gene called BRCA, that the pharmaceutical industry became interested.

Fast forward to today and I'm pleased to report our continued research, initiated in the 1990s, has not only led to the first drug of its kind being developed and trialled in Newcastle but has also heralded a new era in cancer treatment.

PARP has now been adopted as a key cancer target by the global pharmaceutical industry, and has reached patients across Europe, the Americas, Australasia and Asia. As many as eight PARP inhibitors are currently being developed, and major companies have invested around \$385 million in clinical trials to date. Since 2008, more than 7,000 patients have been treated with the drugs as part of the trials.

The work has been published widely, in journals including *Nature*, *Cancer*, *JNCI* (the Journal of the National Cancer Institute), *Clinical Cancer Research* and *Molecular Cancer*

*Therapeutics*. In 2010, the research underpinning the discovery and development of PARP inhibitors was formally recognised by Cancer Research UK. CRUK awarded their inaugural Translational Cancer Research Prize to the Newcastle PARP team "in recognition of the discovery and development of novel PARP inhibitors, specifically the achievement of the team in driving an initial scientific concept through medicinal chemistry and preclinical work, to first-in-man clinical studies".

The drugs are designed to target the weakness in cancers and work by blocking the action of PARP – an enzyme involved in the repair of damaged DNA. By themselves, PARP inhibitors are unable to kill cancer cells but when used to target cancer cells that lack a protein normally produced by BRCA genes, which is also involved in DNA repair, the two factors act together to attack the cancer cell. The cancer cells are no longer able to repair DNA damage and ultimately die, while leaving healthy cells unscathed. The treatment also has fewer side effects than chemotherapy.

PARP inhibitors also work in concert with conventional chemotherapy to attack other cancers. Our trials have



proven the potential of PARP inhibitors in combination with chemotherapy drug, temozolomide. Two of the 33 patients treated for malignant melanoma in the Phase I trial in 2003 and five out of 40 patients treated in the Phase II trial in 2005 are alive today and in remission, despite being diagnosed with incurable melanoma and having a life expectancy of just a few months when they were recruited to take part in the study.

According to the National Cancer Institute, between one in 400 and one in 800 women have a BRCA mutation. Of these 60% or more will develop breast cancer and 15-40% will develop ovarian cancer. With the continued work and dedication of our team, we are bringing new hope and new treatments to those affected by this devastating disease.

[nicola.curtin@ncl.ac.uk](mailto:nicola.curtin@ncl.ac.uk)

# Tackling dementia

Dementia devastates the lives of 36 million people worldwide and costs \$315 billion in healthcare. Ian McKeith, Professor of Old Age Psychiatry, is part of a team of researchers and clinicians specialising in dementia research at Newcastle University's Institute for Ageing and Health.

Professor McKeith leads research that resulted in the first diagnosis and treatment of dementia with Lewy bodies (DLB), a condition affecting over 4 million people worldwide which is now known to be the second most frequent cause of degenerative dementia after Alzheimer's disease. Yet little more than a decade ago the disease was relatively unknown and those affected by it were often treated with drugs that could worsen their unpleasant symptoms, or even prove fatal.

Until the team at Newcastle University developed a new brain imaging technique to identify DLB, the mental symptoms of sufferers – such as memory loss and confusion – were often mistaken for Alzheimer's disease, while the motor symptoms, including gait and slowness of movement, were mistaken for Parkinson's disease.

The breakthrough came when the team identified that cholinesterase inhibitors (CHEIs), a class of drug originally

developed for use in Alzheimer's disease, would be of greater benefit in DLB and also in Parkinson's disease dementia.

The research has been published in *The Lancet*, *The Lancet Neurology*, *BMJ* and *Neurology*. CHEIs are now recommended in national and international guidelines for the cognitive and psychiatric symptoms associated with both of these conditions which previously had no effective treatment.

Professor McKeith explains: "The DaTSCAN brain imaging technique developed in collaboration with GE Healthcare for use in dementia diagnosis, and the class of drug that we were the first to test in a large, placebo-controlled, randomised trial, are now in use around the world. These have revolutionised the lives of patients. For the first time, we are able to manage symptoms such as cognitive failure, hallucinations, apathy and anxiety.



"We have come a long way in our understanding of this debilitating and distressing condition. The momentum we have created has enabled us to establish world-class facilities at Newcastle University. In collaboration with other international groups, we are now using our tissue resource to investigate why brain cells become dysfunctional. We are also planning to take part in the first trials to arrest the disease process."

[ian.mckeith@ncl.ac.uk](mailto:ian.mckeith@ncl.ac.uk)

**"The basic science and cutting-edge translational research carried out at Newcastle University highlighted the benefits of diagnosis of DLB and of the cholinesterase drugs, each of which has had a significant influence on clinical practice."**

Alistair Burns, National Clinical Director for Dementia.

# Protecting Future Generations

Newcastle University is developing a pioneering IVF (in vitro fertilisation) technique to protect future generations from the risk of mitochondrial disease. Professors Doug Turnbull and Mary Herbert are both members of the Wellcome Trust Centre for Mitochondrial Research at the University where the team is integrating international quality research with training for new scientists and engaging with policy makers, patients and the public.

Mitochondria are often described as the batteries of our cells. In some people there is a fault in these batteries which can cause mitochondrial diseases.

Mitochondrial diseases are passed from mother to child down the maternal line. Every year, around one in 6,500 children are born with severe mitochondrial diseases which include muscular weakness, blindness, heart failure, liver failure, learning disability and diabetes, which can lead to death in early infancy.

The new IVF technique being developed by Newcastle University involves transferring the nuclear DNA from an oocyte or zygote from a mother with mitochondrial DNA mutations into a donor egg that has had the nuclear DNA removed. Any child born as a result of this technique would have the nuclear DNA from its parents,

but the healthy mitochondria from the donor egg. This would allow the mother to give birth to a healthy child, thus eliminating mitochondrial diseases from the family line.

With funding from the Wellcome Trust, the University is refining the technique to ensure families affected by mitochondrial diseases are able to access these technologies in the clinic at the earliest opportunity.

In June 2013, the Chief Medical Officer outlined support for a change in the law which paved the way for the technique to be used in patients. Draft regulations have been published and a final version for debate in Parliament is expected this year.

[doug.turnbull@ncl.ac.uk](mailto:doug.turnbull@ncl.ac.uk)



One of those affected with mitochondrial disease is Nicola Parker (pictured above with Professor Doug Turnbull) who did not know she had Mitochondrial Myopathy, a condition which reduces her energy levels and restricts her movement, until she had already passed it on to her daughter.

Nicola says: "No parent would ever want to pass on an illness to their child, so this work should be applauded. It means my daughter could now have the chance of being a mother herself one day, without the risk of this genetic condition being passed on again."

To find out more about the pioneering IVF technique scan here.

