



Vice-Chancellor's Innovation Awards 2018



From the **Vice-Chancellor**



I am delighted to introduce these awards and celebrate the quality and breadth of research-led innovation across the University.

It has been simply wonderful to see the calibre and the diversity of projects undertaken here in Oxford. Of the 78 entries we received, we have awarded four winners and have highly commended a further thirteen projects across the four categories – Team Work, Building Capacity, Inspiring Leadership, and

Early Career Innovators. The range of projects, products, and models featured in today's ceremony are testament to the excellence of the innovation taking place across the University's four divisions and there is clearly the potential to innovate even further in the future. I am very grateful to Professor Ian Walmsley, Pro-Vice Chancellor for Research and Innovation, for championing this work.

As a University, we are committed to global leadership in knowledge exchange, innovation and entrepreneurship, ensuring our research, scholarship and teaching contribute to the good of the nation and the world. A vibrant innovation culture will in turn sustain research and teaching excellence by helping to attract and support exceptionally talented students and staff whose insight and creativity is the engine of knowledge creation and exploitation.

Best wishes,

A handwritten signature in black ink that reads "Louise Richardson". The signature is fluid and cursive.

Professor Louise Richardson

TEAM WORK WINNER



Mitigation of arsenic mass poisoning: a unified experimental and theoretical approach

Dr Ian Griffiths (Mathematical Institute), **Dr Raka Mondal** (Mathematical Institute), **Professor Sirshendu De** (Indian Institute of Technology Kharagpur), **Dr Sourav Mondal** (Indian Institute of Technology Kharagpur)

The Ganges–Brahmaputra Delta is a global hotspot for arsenic groundwater contamination. Naturally occurring arsenic concentrates in water drawn from deep wells, creating a major public health issue in West Bengal and Bangladesh, which has been described as the largest mass poisoning of a population in history.

A novel technology has recently been discovered by Griffiths's collaborator, Professor Sirshendu De (IIT Kharagpur), which uses naturally abundant laterite soil to filter arsenic. The technology has the potential to provide a



global breakthrough, supplying clean water to the world. However, to achieve this, a sound quantitative understanding of its performance is essential, which can only be obtained through the development of mathematical models.

Griffiths has developed a mathematical framework using homogenization theory and asymptotic analysis that distils the complex process into a simple predictive tool, which predicts the two key features: how frequently filters must be replaced, and how the filters may be upscaled to serve, for example, a school or community.

The filters serve more than 5000 people, and 40 community-scale filters are now being deployed. The mathematical tools provide the essential guidance needed for engineers to maintain current filters and deploy these new filters in a cost-effective manner.



TEAM WORK HIGHLY COMMENDED

Building Strategic Partnerships in Digital Health

Dr Adam Stoten (Oxford University Innovation), **Dr Paul Ashley** (Oxford University Innovation), **Dr Fred Kemp** (Oxford University Innovation), **Dr James Groves** (Oxford University Innovation), **Dr Richard Liwicki** (Research Services), **Ms Barbara Murray** (Research Services), **Mr Geoff Lees** (Legal Services), **Prof. Lionel Tarassenko** (Department of Engineering), **Mr Charles Lescot** (Oxford University Hospitals NHS Foundation Trust), **Mr Jason Dorsett** (Oxford University Hospitals NHS Foundation Trust), **Mr Peter Knight** (Oxford University Hospitals NHS Foundation Trust), **Dr Chris Bunch** (Oxford University Hospitals NHS Foundation Trust)

The National Health Service is in crisis. Constrained spending for a population with increasing healthcare demands means it is critical that we adopt innovative strategies for delivering healthcare in the 21st century. Digital technology has revolutionised our lives, including the way we shop, relax, work and communicate. However, the failure of academic institutions, healthcare providers and companies to work in close partnership has blocked the most innovative ideas in digital healthcare being translated from lab to patient bedside.

In July 2017 The University of Oxford, The Oxford University Hospitals NHS Foundation Trust, Oxford University Innovation (OUI) and Drayson Health set out to solve this problem by establishing a 5-year Strategic Research Agreement (SRA) to develop, validate and bring to market advanced digital health technologies for the benefit of the NHS. This



partnership has already led to Drayson Health taking on four technologies and rolling these out in Oxfordshire and beyond. As part of the agreement, Drayson Health is funding research within the University, supporting the continued development of digital health innovation in Oxford. Furthermore, as the financial returns from the commercialisation of these technologies will be shared with the University and NHS, this is an innovative model which will create enduring and wide-ranging benefits.



TEAM WORK HIGHLY COMMENDED

GDM-healthTM: real-time management of gestational diabetes

Dr Lucy Mackillop (Nuffield Department of Women's and Reproductive Health), **Professor Lionel Tarassenko** (Department of Engineering Science), **Dr Carmelo Velardo** (Department of Engineering Science), **Dr Jane Hirst** (Nuffield Department of Women's and Reproductive Health), **Katy Bartlett** (John Radcliffe Hospital)

Gestational diabetes mellitus (GDM) affects 5%-16% of all pregnancies in the UK and can lead to complications for the mother and baby if blood glucose (BG) is not tightly controlled. Women require hospital visits every 1-2 weeks. The cost and burden of GDM for both the NHS and the patient are high.

The GDM-Health management system provides real-time management of GDM without the need for such frequent hospital appointments. The system was co-designed by engineers and clinicians with patients. It comprises a smartphone app, with a Bluetooth-enabled blood glucose meter, for the patient;

and a secure website, with optimised data presentation and alerting algorithms, for healthcare professionals. The app automatically transmits the blood glucose measurements to the website, along with annotations entered by the patient. In addition, the app provides visual feedback on blood glucose control to the patient. The system has built-in capability for communication between healthcare professionals and the patient, using messaging to support self-management.

GDM-Health has been extensively evaluated and is associated with significantly higher patient satisfaction, reduced caesarean sections and cost savings. GDM-Health has been licensed to Drayson Health in a strategic partnership that allows royalties to be invested back into the University and NHS Trust.



BUILDING CAPACITY WINNER



Smart Handpumps

Dr Robert Hope (School of Geography and the Environment), **Dr David Clifton** (Department of Engineering Science), **Mr Patrick Thomson** (School of Geography and the Environment), **Dr Achut Manandhar** (Department of Engineering Science), **Ms Heloise Greeff** (Department of Engineering Science), **Ms Farah Colchester** (Department of Engineering Science), **Ms Johanna Koehler** (School of Geography and the Environment), **Mr Alex Fischer** (School of Geography and the Environment)

844 million people lack access to basic drinking water. The majority live in Africa and Asia, often depending on handpumps, which lift groundwater. When a pump breaks in a school, clinic or community, it usually takes weeks or months to repair. The health, education and economic costs for women and girls are enormous but avoidable. Smart handpumps are an innovative technological and institutional response. A novel transmitter installed in the handle automatically sends



data to alert local maintenance providers. This has reduced the time to repair handpumps from a month or more to a day. People now make mobile payments to the maintenance providers, which has expanded the service to over 60,000 people in Kenya. The research has led to a change in the Kenyan Water Act, the incubation of two social enterprises, and a legally-registered trust fund blending user, private and public finance. With UNICEF we are testing the approach in schools in Bangladesh. Machine learning is modelling the vibration data to predict the depth of the groundwater and to estimate when the pump might break. Smart handpumps may mean failures will be a thing of the past; they will help to deliver the SDG goal of universal water for all.



BUILDING CAPACITY HIGHLY COMMENDED

LAB282

LAB282 is a multi-partner team including **Oxford University Innovation** (OUI), **Oxford University, Oxford Sciences Innovation** (OSI), and **Evotec** representatives which is managed operationally by **Dr Richard Reschen** of OUI and **Dr Thomas Hanke** of Evotec

There is currently a lack of funding and industrial expertise available to help translate innovative, world class, biomedical discoveries at Oxford University into next generation drug discovery programmes that can be commercialised for patient benefit. LAB282 (www.lab282.org) is a ground breaking £13m partnership which seeks to bridge this gap, via funding and the provision of industrial expertise and resources. The scheme is a collaboration between Oxford University, the global drug discovery company Evotec, and the investment fund Oxford Sciences Innovation (OSI).

The partnership accepts applications from all Oxford biomedical academics and offers funding (from £50k to £500k) and access to industrial expertise and drug discovery resources not available at the University. Most



funded projects involve work in both the academics' lab and at Evotec, in order to take projects ideally to preclinical proof-of-concept, by blending the best of academic and industrial drug discovery and development expertise.

A key part of the award scheme is the dedicated Expert-In-Residence from Evotec, who helps select and plan projects together with the academics and Evotec scientists. The end goal is to generate industry-validated data and intellectual property which can be used to seed the formation of new companies to develop the next generation of patient therapies.



LAB282



BUILDING CAPACITY HIGHLY COMMENDED

Parenting for Lifelong Health

Professor Lucie Cluver (Social Policy and Intervention), **Professor Frances Gardner** (Social Policy and Intervention), **Dr Franziska Meinck** (Social Policy and Intervention), **Dr Jenny Doubt** (Social Policy and Intervention), **Ms Janina Steinert** (Social Policy and Intervention), **Ms Sally Medley** (Social Policy and Intervention), **Ms Camille Wittesaele** (Social Policy and Intervention), **Ms Rocio Herrero Romero** (Social Policy and Intervention), **Mr Jamie Lachman** (Social Policy and Intervention)

Africa has the highest rates of child abuse in the world, but no programmes that have been shown to prevent this. Academics at Oxford University worked with the World Health Organisation, UNICEF and the University of Cape Town to create and scientifically test a series of free workshops to support families in bringing up their teenagers. The Sinovuyo Teen Programme took five years to develop and improve. It was tested in a large study with over a thousand people in forty villages and towns in South Africa. The results were published in the British Medical Journal Global Health in



2018. The programme reduced family violence, increased parental involvement and supervision of teenagers, reduced mental health and drug and alcohol use challenges, and improved budgeting, with families less likely to run out of food, electricity and transport money at the end of each month.

The programme is now recommended by the Global Partnership to End Violence against Children www.end-violence.org and is available on the World Health Organisation's website www.who.int/violence_injury_prevention/en/

It is being delivered to an estimated 300,000 families in Cote D'Ivoire, Democratic Republic of Congo, Haiti, Kenya, Lesotho, Malawi, South Sudan, South Africa, Swaziland, Tanzania, Thailand, The Philippines, Uganda and Zimbabwe.



INSPIRING LEADERSHIP WINNER



FLEX-SR (A FLEXible new approach to automatic Speech Recognition)

Professor Aditi Lahiri (Faculty of Linguistics, Philology and Phonetics)

A key principle of the Featurally Underspecified Lexicon (FUL) model, built within the framework of linguistics, is that “phonological features” (the articulatory and acoustic properties that make one sound crucially contrast with another) should have rigorous definitions and a finite set should adequately cover all the distinctive sounds across the languages of the world. This makes it possible for the FUL concept to be used as the basis of a novel Automated Speech Recognition (ASR) engine, and this idea was explored and developed under the ERC-funded WORDS project and the related Proof of Concept grant.

The FUL ASR system examines the acoustic properties of a speech sound and extracts distinctive features from it. These features are then matched against a lexicon to identify the words used. The result is an ASR system that requires little training, and employs theoretical insights from the study of how the human brain processes speech to emulate this process on the computer.



Based on these principles, a mobile phone language learning application was produced enabling second language learners to improve their pronunciation. Words and sentences spoken into the App are analysed, and specific feedback is given like a personal tutor to improve and correct mistakes.



INSPIRING LEADERSHIP HIGHLY COMMENDED

Global Jet Watch for Social Change

Professor Katherine Blundell (Department of Physics)



A key aim in astrophysics is to understand how matter behaves in the vicinity of black holes in galaxies across the Universe, especially those in our own Milky Way. Measurements taken only days or even hours apart can show huge changes, for

example ejecting massive jets of matter or tearing apart neighbouring stars. Continuity of monitoring helps scientists understand more about how these highly dynamic systems work.

Watching rapidly evolving objects from Earth, however, poses a problem. Optical telescopes can only make observations during the hours of darkness. To get around this limitation we secured funding from a range of organisations, charities and individuals to establish a network of five observatories around the world. As

night-time ends in one location, observations are continued by the next observatory round in longitude.

A goal in establishing these observatories was to benefit schoolchildren in the developing world particularly in cultures that do not traditionally think of girls as scientists or engineers. Four of the five observatories are located in residential schools, who use the telescopes to inspire an interest in science, maths and engineering. After the students go to bed, the telescopes are operated by remote control in Oxford, collecting astrophysical time-series data.



INSPIRING LEADERSHIP HIGHLY COMMENDED

Superglues from Pathogenic Bacteria

Professor Mark Howarth (Department of Biochemistry)

Synthetic biology, the engineering of living systems, is likely to generate major changes to society in areas including energy, healthcare and agriculture. Proteins are powerful tools in synthetic biology because of their diverse activities, including catalysing reactions and sensing changes in the environment. Nowadays engineering of individual proteins is often efficient. Nonetheless proteins usually work in teams and it has been a major challenge to

control how proteins come together into larger assemblies. The problems come from unstable or non-specific links between the different proteins. Howarth's group has established a powerful new approach to connect proteins of interest. This approach, SpyTag and SpyCatcher, harnesses chemistry from the dangerous bacterium *Streptococcus pyogenes*. Simply upon mixing, SpyTag and SpyCatcher form a specific and unbreakable bond with each other, locking together the two proteins of interest. This protein superglue works in bacteria, worms, mammals and plants and has been used by many students, academics and companies. Howarth's group has applied SpyTag to make "SpyRing" enzymes resilient to boiling, capture circulating tumour cells with high sensitivity, and accelerate vaccine generation. This new vaccine platform has led to the spinout SpyBiotech, showing strong potential against global health challenges including malaria, cytomegalovirus and HIV.



INSPIRING LEADERSHIP HIGHLY COMMENDED

Where am I? Large Scale Infrastructure-Free Navigation for All The Vehicles - From An Oxford Lab to a Globally Leading Company

Professor Paul Newman (Department of Engineering Science)

From 2005 to 2017 Paul Newman led the Oxford Mobile Robotics Group (MRG) within the Dept. of Engineering Science. In 2017 MRG became the Oxford Robotics Institute. During this time he led the development of a suite of technology that enabled autonomous vehicles to navigate with zero dependence on infrastructure at scale. It is a foundation technology.

The Oxford Driverless Car program is perhaps the most visible and well known output of this. Working with BAE and then Nissan as part of an EPSRC Leadership Fellowship and then a Programme Grant, Newman laid the foundations for the UK's driverless car initiative which is now a high profile strategic mission for the nation and was mentioned in the Queen's speech. The UK's code of practice for autonomous vehicles is based on the Oxford Safety Case developed at Begbroke and trialled with the Department for Transport.

In 2015 Newman and his colleague Ingmar Posner spun out Oxbotica to commercialise this and related technology – the goal being to revolutionise what everyday vehicles can do for society. The technology developed by



Oxbotica, which has its heritage in the labs of the University, is applicable to all vehicle domains. For example in late 2017 on one single day, Oxbotica was running autonomous vehicles in Heathrow (planeside), a mine in Australia, a port in Singapore, 3 road-vehicles in the UK Midlands, a warehouse in Vienna and a Campus in Pasadena.

Such is the strength of Oxbotica, that it has traded since day one and the University remains a major share holder and quite rightly, the recipient of nearly 500k of licensing revenue.



INSPIRING LEADERSHIP HIGHLY COMMENDED

Special Economic Zones for Refugee Employment

Professor Alexander Betts (Oxford Department of International Development), **Professor Paul Collier** (Blavatnik School of Government)

Most refugees flee to neighbouring haven countries where jobs are scarce. The governments of these havens consequently deny them the right to work. Refugees pass years dependent on aid in camps, or take clandestine work in which they are highly vulnerable. In April 2015, Betts and Collier were invited to Jordan to undertake fieldwork on the Syrian refugee crisis. Based on this and their years of complementary prior research, Betts on refugees, Collier on economic development, they proposed a new model as an alternative

to camps. This was to attract firms to Jordan's Economic Zones, generating jobs that could be shared between refugees and Jordanians. The Government of Jordan agreed to pilot it. Betts and Collier convinced the British Government and the World Bank of its viability, and the European Commission agreed to grant Jordan market access to encourage firms to produce there. The model became the basis of the Jordan Compact. This has resulted in over 80,000 work permits for Syrian refugees in a country that previously denied them the right to work. The model is now going global. Ethiopia has adopted the approach and the World Bank has created a new \$2bn fund to support refugee haven countries.



EARLY CAREER WINNER



Trusted Source Knowledge Transfer Partnership

Ms Alice Purkiss (Humanities Division)



Trusted Source was a Knowledge Transfer Partnership (KTP) between the University of Oxford and the National Trust which responded to the challenge of creating resilient and long term relationships between the heritage sector and academia.

The project created an online knowledge bank of concise, engaging and accessible articles about history, culture and the natural environment, crowdsourced from 'trusted sources' across academia and the National Trust. These evergreen articles explore a range of subjects from different academic perspectives, therefore offering National

Trust visitors and online users a spectrum of insights into the charity's diverse portfolio. Articles include definitions of specialist terms, in addition to profiles on the people and historical movements related to the Trust's historic places, landscapes and collections.

Trusted Source articles and author profiles are featured across the National Trust's website, and are also used to inform property interpretation, staff and volunteer training, and marketing materials.

See www.nationaltrust.org.uk/ktp

After the initial 2-year KTP (February 2016 – 2018), supported by InnovateUK and the AHRC, Trusted Source has now been built into business as usual at the National Trust and will be supported going forward as a core workstream in the new National Trust Partnership Office at the University of Oxford.



EARLY CAREER HIGHLY COMMENDED

The Future of Employment: How Susceptible are Jobs to Computerisation?

Dr Carl Benedikt Frey (Oxford Martin School)

In this project, Frey and his team developed a novel approach to measure the exposure of jobs to automation. They did so against a background of the rapidly expanding scope of tasks computer technologies can perform, following recent developments in machine learning and various sub-fields of artificial intelligence. They began by asking in which tasks do human workers still hold the comparative advantage despite these advances in technology. To answer this question, they gathered a group of machine learning and mobile robotics experts at the Department of Engineering Sciences, to determine



current boundary conditions (or engineering bottlenecks) to automation. In a second step, using detailed data on occupational descriptions, they employed machine learning algorithms to examine how intensive jobs are in tasks that correspond to the identified bottlenecks to automation, allowing them to assess the exposure of existing jobs to new technologies.

This approach provides policy makers with valuable information about i) the potential scope of automation in terms of the share of jobs that are at risk of disappearing; ii) the types of skills that the educational system needs to provide; iii) a framework for understanding some of the impacts of new technologies on labour markets going forward.



EARLY CAREER HIGHLY COMMENDED

Interdisciplinary Study of Energy use and Activities

Dr Phil Grunewald (School of Geography and the Environment)

Understanding the timing of energy demand is becoming ever more important. The uptake of renewable sources of energy, such as wind and solar, is accelerating and systems have to accommodate their sometimes volatile outputs. Much hope rests on electricity storage and flexible demand to assist in this challenge.

However, little is known about the social patterns and activities that drive the daily ups and downs of energy demand and much less about the most effective means to change such patterns for the benefit of low carbon energy provision.



This project combines engineering and social sciences to better understand the nature of demand and its flexibility. Aside from several methodological advances Grunewald and his team have developed two innovative physical instruments: 1) an electricity recorder which households can easily self-install and 2) an app which makes the recording of activities easy and enjoyable.

The data from 100s of households provides fascinating new insights into household activity patterns and their implications for energy consumption.

Grunewald is particularly proud of the calibre and disciplinary breadth of the people involved, which is so uniquely possible in Oxford. Grunewald collaborates engineering (system flexibility), computer science (app development), sociology (time-use) and philosophy (ethics of energy data and intervention).



EARLY CAREER HIGHLY COMMENDED

21st Century Terrorist Political Adaptation to Western Policy

Miss Melissa Skorka (History Faculty)



This project has created new synergies between academia and public institutions, while promoting Oxford's Changing Character of War Programme as a world-leader in policy-relevant research-led innovation. The project has combined historical and political analysis of the al Qaeda-affiliated Haqqani network in Pakistan and eastern Afghanistan, showing the impact of U.S. policy evolution, not least through its use of human shields and manipulation of Pakistan's state strategies. This notorious movement itself is a product of a symbiosis between traditional

clan polity and modern sub-state actors, but practices a very modern form of coercive politics. The Haqqani pursues its own line of policy, yet uses a combination of old and new methods of war to achieve it. Promoting novel ways of addressing this subject – terrorist political adaptation to Western policy – fits exactly with Oxford's innovation strategy and the contemporary challenge of global security.

If resolutions to the violent path of Haqqani could be found, it would present us with a set of tools for the more effective analysis and applied knowledge of conflict termination in other parts of the world. This project has been acknowledged by the National Security Advisor of the U.S. administration, resulting in adjustments in U.S. foreign policy.



EARLY CAREER HIGHLY COMMENDED

Women Speak Out: An Academic-Community Collaboration to Explore the Links Between HIV, Gender-Based Violence and Human Rights Among Women with Drug Dependence

Dr Claudia Stoicescu (Department of Social Policy and Intervention)

Women Speak Out is an academic-community collaboration between Oxford University and the Indonesian Drug Users Network aimed at addressing HIV and gender-based violence among drug-using women in Indonesia. Over 730 women who inject drugs participated in the baseline research, making it the country's largest study with this marginalised population. The collaboration applied a community-based participatory approach at all stages of the research process. Women with lived experience of drug use were trained and equitably engaged in grant development, study design, implementation and dissemination. Findings showed that injection drug-using women shouldered a burden of intimate partner violence up to 24 times higher than women in the general population, which exacerbated their HIV risk by over 26%. At the same time, drug-using women faced inadequate access to health and legal support services. Guided by the findings and building on the capacities gained by the women through the project, researchers and community partners secured seed funding



to establish a new network of women who use drugs with representatives across 12 provinces. The initiative focuses on female empowerment, knowledge exchange and the realisation of drug-using women's right to health. As one of a few projects globally to successfully combine rigorous research with meaningful community involvement, *Women Speak Out* represents a best practice model for impactful and sustainable academic-community partnership.



EARLY CAREER HIGHLY COMMENDED

Putting 'no deforestation' into Practice in Tropical Commodity Industries

Dr Jennifer Lucey (Department of Zoology)

Palm oil (PO) is the world's primary source of vegetable oil, and rapid expansion of the industry has caused widespread deforestation. The Roundtable on Sustainable palm oil (RSPO) certification standard was set up to address these issues.



However, RSPO has been criticised for not going far enough on deforestation policy, threatening its credibility. This impacts on market demand and premiums for sustainable product which is bad for responsible companies,

bad for the future prospects of a sustainable PO industry and therefore bad for biodiversity, carbon emissions and livelihoods. 40% of PO production, globally, is from smallholdings but RSPO certification has had limited uptake by smallholders due to the complexities of the certification process. Lucey worked with key stakeholders to use her research and the wider scientific evidence base to “put no deforestation into practice”.

Lucey's synthesis of forest fragmentation was pivotal in developing industry policy for avoiding deforestation, now operating over millions of hectares in the tropics, and for simplified environmental assessment for smallholders to enable greater participation in RSPO certification. Lucey also used data from her research to develop and test a tool for industry to monitor their forest set-asides, enabling long term effectiveness of no-deforestation policy.



“As a University, we are committed to global leadership in knowledge exchange, innovation and entrepreneurship, ensuring our research, scholarship and teaching contribute to the good of the nation and the world.”

*Professor Louise Richardson
Vice-Chancellor, University of Oxford*

