The research commercialisation office of the University of Oxford, previously called **Isis Innovation**, has been renamed **Oxford University Innovation**

All documents and other materials will be updated accordingly. In the meantime the remaining content of this Isis Innovation document is still valid.

URLs beginning www.isis-innovation.com/... are automatically redirected to our new domain, www.innovation.ox.ac.uk/...

Phone numbers and email addresses for individual members of staff are unchanged

Email : enquiries@innovation.ox.ac.uk

ISIS INNOVATION

UNIVERSITY OF OXFORD

Oxford Academic Health Science Network

eHealth and Big Data
Innovation with Impact 2015
Isis Innovation & Oxford AHSN Technology Showcase

www.isis-innovation.com

Programme

Time	Session	Topic
10.00am–10.30am		**Registration with tea/coffee**
10.30am–10.40am	**Session 1: Innovation**	**Welcome and Keynote Speech** *Mr Tom Hockaday and Dr Nick Scott-Ram*
10.40am–11.00am		**Keynote Speech** Personalised Health and Care 2020 *Dr Paul Rice*
11.00am–11.15am		Big problem, big data, big solution? Data repurposing for dementia research *Professor Simon Lovestone*
11.15am–11.30am		Digital Innovation in Cardiology Clinical Pathways *Dr Piers Clifford*
11.30am–11.45am		Brainomix – Improving stroke diagnosis *Dr Michalis Papadakis*
11.45am–12.00pm		Smart Oxford *Mr Llewelyn Morgan*
12.00pm–12.10pm		**Keynote Speech** *Professor Ian Walmsley*
12.10pm–1.30pm		**Lunch and Exhibition**
1.30pm–1.50pm	**Session 2: Data and Networking**	**Keynote Speech** Why do we need a Data Guardian? *Dame Fiona Caldicott*
1.50pm–2.05pm		Big Data for Population Health *Professor Martin Landray*
2.05pm–2.20pm		True Colours – Involving the Patient *Dr Chris Hinds*
2.20pm–2.35pm		Chronic Disease Management and Digital Health *Professor Kazem Rahimi*
2.35pm–2.50pm		Down to Earth *Dr Geraint Morgan*
2.50pm–3.20pm		**Afternoon tea break**
3.20pm–3.40pm	**Session 3: Local Enterprise and Application of Innovation**	**Keynote Speech** Innovation in Oxfordshire, new partnerships, networks and opportunities *Professor Alistair Fitt*
3.40pm–3.55pm		Oxehealth – Disruptive Innovation in Medical Technology *Professor Lionel Tarassenko*
3.55pm–4.10pm		Adoption of Gestational Diabetes Monitoring *Ms Tracey Marriott and Dr Lucy MacKillop*
4.10pm–4.25pm		Diagnosis of Rare Diseases through Photographs *Dr Christoffer Nellaker*
4.25pm–4.45pm		**Keynote Speech** From Innovation to Application *Mr Andy Walker*
4.45pm–5.15pm		**Expert panel discussion** *Session Chair – Professor Lionel Tarassenko*
5.10pm–6.00pm		**Drinks, nibbles and networking in the exhibition**

Posters

Assisted Vision	*Dr Stephen Hicks*
Beyond Perfusion: Measuring Blood Supply	*Professor Michael A. Chappell*
Bounts	*Mr John Stuart*
Deontics Clinical Pathways and Decision Support	*Dr Guy Wood-Gush*
Diabetes care pathway shared decision making tool	*Dr Matt Reaney*
Type 2 Diabetes Fracture Risk Predictor	*Associate Professor Daniel Prieto-Alhambra*
DIABLO: Detection of Infectious Agents By Laser Optics	*Dr Jane Hodgkinson & Dr Christopher Walton*
Dynamic Consent	*Professor Jane Kaye*
Gait Analysis	*Dr Ryan Pink*
Intelligent Ultrasound	*Mr Andrew Barker & Professor Alison Noble*
Joint Tracker	*Mr Paul Monk*
Message Dynamics	*Mr Peter Hayward*
Microbial WGS workflow	*Professor Derrick Crook & Dr Helen Barker*
Mykrobe predictor – antibiotic resistance prediction for S. aureus and M. tuberculosis from genome sequence data in minutes	*Dr Zam Iqbal*
OpenClinical.net: a new way to promote best clinical practice	*Professor John Fox*
Oxford Genome Wide Analysis Software Suite	*Professor Jonathan Marchini*
P1vital – A Precision Medicine Approach to Antidepressant Treatment in Depression	*Mr Jonathan Kingslake*
Ribosomal MLST: Universal bacterial typing using whole genome sequences	*Dr Keith Jolley, Professor Martin Maiden & Dr James Bray*
The Global Health Network	*Professor Trudie Lang*
This is Isis Outcomes	*Dr David Churchman*
TuteMate, the Tutorial Booking Website: Learn, Teach and Connect	*Dr Eugene Ong*
Virtual Assay: software for the evaluation of safety and efficacy of medicines and drugs	*Professor Blanca Rodriguez*
Zegami	*Mr Stephen Taylor*

Welcome to eHealth & Big Data – Innovation with Impact

The Oxford eHealth & Big Data event, our 2015 Technology Showcase, highlights the latest and most exciting opportunities and projects in this area from Oxford University and the Oxford Academic Health Science Network, our co-hosts and partner. It brings together people from research, business and healthcare to share and explore their insights, to improve efficiencies of diagnosis and treatment, and ultimately to benefit patients.

Isis Innovation was created by the University of Oxford in 1988 to identify, protect and commercialise IP from the University. Today we support University researchers by transferring technologies and expertise to existing industry and new ventures.

The arrival of smart devices means eHealth and Big Data are themes that will increasingly affect each of us. The talks and posters presented today represent just a small portion of the projects being developed in Oxford and the region. We hope that they are the seeds for productive discussions leading to new product and service development

Mr Tom Hockaday
CEO

Healthcare systems are undergoing profound changes as new care settings and challenges in quality and efficiency combine to deliver new patient-focused solutions. Digital technology is at the heart of this transformation, spanning the complexities of big data and clinical interpretation through to the delivery of service improvements supported by new digital tools.

Underpinning this is the need to ensure strong governance and effective management of patient data. Strong alignment across the whole innovation pathway between innovators, universities, NHS partners and industry will also be a pre-requisite for success. This meeting is intended to capture some of these exciting developments.

The Oxford AHSN was created to bring together the NHS, universities, business, patients and the public to promote best health for our population and prosperity for our region. We are delighted to be a partner with Isis Innovation and have the opportunity to share a selection of transformative innovations being developed from across the region.

Dr Nick Scott-Ram
Director of Commercial Development
Oxford AHSN
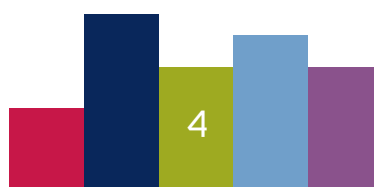
Welcome to eHealth & Big Data – Innovation with Impact

Isis Innovation

Isis Innovation is a world leading technology transfer business owned by the University of Oxford. It creates links between the outstanding research capability at Oxford, and elsewhere, for the benefit of society in the UK and globally. We work for universities and industry to transfer technologies and expertise, with investors to support early stage companies and with government to develop sustainable economic growth.

Our Technology Transfer group manages Oxford University's IP by investing to protect the intellectual property arising from the University's research activities and then transferring the IP for further investment and development.

Oxford University Consulting manages academic consulting relationships. OUC has facilitated many hundreds of

consulting relationships between academics and clients, often leading to long term collaborations.

Isis Enterprise promotes our expertise commercially around the world, helping technology providers and seekers to source, commercialise and develop new technologies. In addition, Isis Enterprise assists governments and other organisations interested in establishing their own innovation activities, and was recently awarded a Queens Award for Enterprise: International Trade.

The Oxford Academic Health Science Network (Oxford AHSN)

Oxford AHSN brings together the NHS, universities, business, patients and the public to promote best health for the population and prosperity of our region's combined population of 3.3 million, primarily in Oxfordshire, Berkshire and Buckinghamshire. This area is home to world-leading organisations involved in clinical care, life sciences and medical research, education and training, innovation and informatics, and includes 12 Clinical Commissioning Groups, four Local Enterprise Partnerships, ten NHS Trusts, nine Universities and over 350 life science companies.

Breaking down traditional organisational boundaries and building stronger relationships between industry, scientific and academic communities – coupled with better knowledge exchange – will bring lasting benefits as best practice is spread quickly and widely across the NHS.

Oxford AHSN works closely with the Oxford Academic Health Science Centre, a collaboration between the University of Oxford, Oxford Brookes University, Oxford Health NHS Foundation Trust and Oxford University Hospitals NHS Trust focused on research.

Sponsors:
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The Sponsors

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Our Analytics for Healthcare Providers solution offers you a solid foundation for all of your data management, reporting and analytic needs. You can start with the areas of most critical need today and add capabilities as your needs change and grow — all from the same flexible platform. Whether you are facing clinical, operational or financial challenges, we can help you find the insights you need to improve decision making.

Triteq

Triteq is an innovative product design, development & technology consultancy made up of talented teams of brilliant people working together to produce incredible products for a rapidly changing world. Founded in 1992, by Steve Lane and Jackie Berry, who are passionate about product design and making excellence available to everyone, from start-ups and SMEs to blue chip companies.

Our award winning designs are found in hospitals, homes, offices, manufacturing plants, construction sites, airplanes, laboratories and retail outlets all around the world. We have an exemplary track record in medical product design and have supported many start-ups through each stage of the development process.

We listen, ask the right questions and deliver results on time. With a team of fifty in our Hungerford office, plus our sales and marketing team in Oxford, we can respond effectively to our client's needs. We work on early identification of opportunities and risks to significantly increase value, adding commercial reality to early stage projects and increasing the importance and worth of your intellectual property. Talk to us today.

Isis Innovation and the Oxford AHSN would like to acknowledge and thank the MRC for their award to support this event from the MRC Proximity to Discovery scheme.
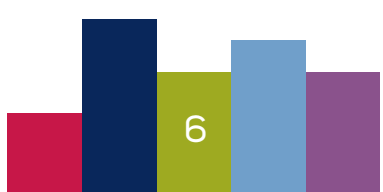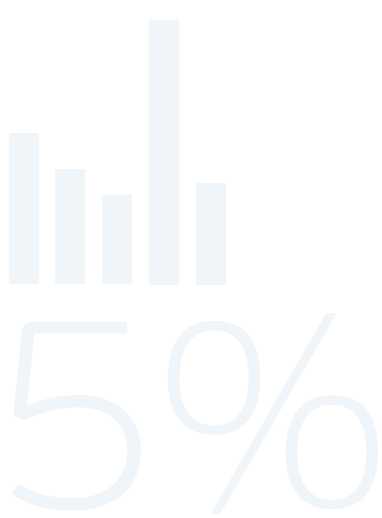
Keynote Speaker Biographies

'Personalised Health and Care 2020' Dr Paul Rice

Paul Rice is the Head of Technology Strategy in the Digital Health team in NHS England. Paul leads the team that is instrumental in delivering a digitally enabled and "paperless" NHS.

For the past two years he has overseen delivery of four major capital funds worth in excess of £300m that help the NHS build the capability to introduce integrated digital care records and enable nurses to transform practice, enabled by technology, to "release time to care".

He was a major contributor to the National Information Board's roadmap document – Personalised Health and Care 2020 – published last November – the first articulation by the health and care system of its commitment to release the benefits of digital technology, data and intelligence. He is currently leading one of the key delivery workstreams. Paul was formerly the Director of the Long Term Conditions

programme in Yorkshire and Humber with a particular focus on Telehealth.

He has been a Primary Care Trust Director, a transformation director in the NHS Modernisation Agency and a policy lead in the Department of Health. He has published and spoken widely on the challenges and opportunities to deliver high quality, efficient and effective service models utilising assistive technology/telehealth/information technology. Paul holds a first degree in Law and Accounting and a Doctorate in Medical Law and Bioethics.

Dr Paul Rice
Head of Technology Strategy,
Strategic Systems and Technology,
Patients and Information, NHS England

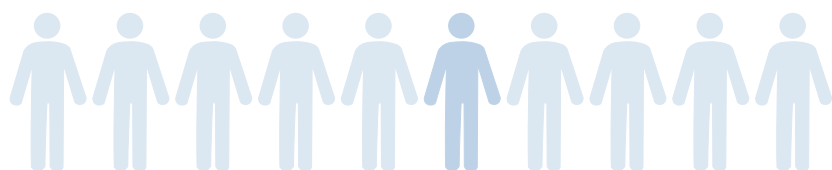## 'Why do we need a Data Guardian?' Dame Fiona Caldicott

Dame Fiona is the National Data Guardian for Health and Social Care, appointed by the Secretary of State for Health in England in November 2014, and also Chair of the Oxford University Hospitals NHS Trust.

She is an Honorary Consultant Psychiatrist and was President of the Royal College of Psychiatrists 1993–6, and Chairman of the Academy of Medical Royal Colleges. From 1996–7 she chaired the Caldicott Committee on patient identifiable data and the National Information Governance Board from 2012–13.

Since then she has chaired the Independent Information Governance Oversight Panel. She was Principal of Somerville College in the University of Oxford from 1996-2010, and a Pro-Vice-Chancellor from 2002-10.
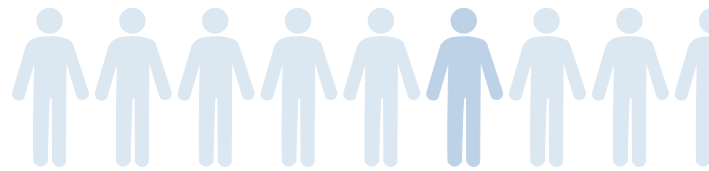
Dame Fiona Caldicott
National Data Guardian for
Health and Social Care

Keynote Speaker Biographies

'Innovation in Oxfordshire, new partnerships, networks and opportunities' Professor Alistair Fitt

Professor Fitt is Vice Chancellor of Oxford Brookes University and a member of the Oxfordshire Local Enterprise Partnership Board.

Alistair was previously Pro Vice Chancellor at Oxford Brookes, with a remit that covered all research and knowledge exchange at the University. He studied at Lincoln College, Oxford, and specialises in industrial applied mathematics research.

Alistair's external involvements include close connections with EPSRC and other funding agencies. He is a long-standing member of the Council of the IMA (Institute of Mathematics and its Applications) and the Executive Secretary of ICIAM, the worldwide organisation for Applied Mathematics.

Professor Alistair Fitt
Vice Chancellor of Oxford Brookes University

'From Innovation to Application' Andy Walker

Andy Walker, is Commercial Director for McLaren Applied Technologies, is responsible for the development & execution of commercial strategy and creating and maintaining relationships with customers and commercial partners.

Specifically, Andy leads much of MAT's business development activity in healthcare including managing the relationship with GSK Pharmaceutical R&D. Prior to joining McLaren, Andy specialised in building innovative, high-tech telecoms businesses, co-founding two venture capital backed software start-ups in Cambridge, UK, raising a number of investment rounds and being part of the management team executing a successful IPO.

With a master's degree in software and microelectronic engineering, Andy worked with blue-chip organisations in Europe, US and Asia. He specialised in technical, business development and international product marketing roles – including secondment to a brand new Silicon Valley office for a UK plc. Using his experience to successfully take to market a new mobile search and navigation service, Andy later became a leading advisor to the mobile internet applications sector and worked for two years as a consultant prior to joining McLaren in 2010.

Mr Andy Walker
Commercial Director for McLaren Applied Technologies

Big problem, big data, big solution?
Data repurposing for dementia research

Alzheimer's disease represents one of the biggest challenges facing health services today. Given the costs involved, 'it could have a bigger impact on the economy in the future. Making progress towards prevention will necessitate new ways of working and Big Data platforms that have been established in Europe with this in mind will be described
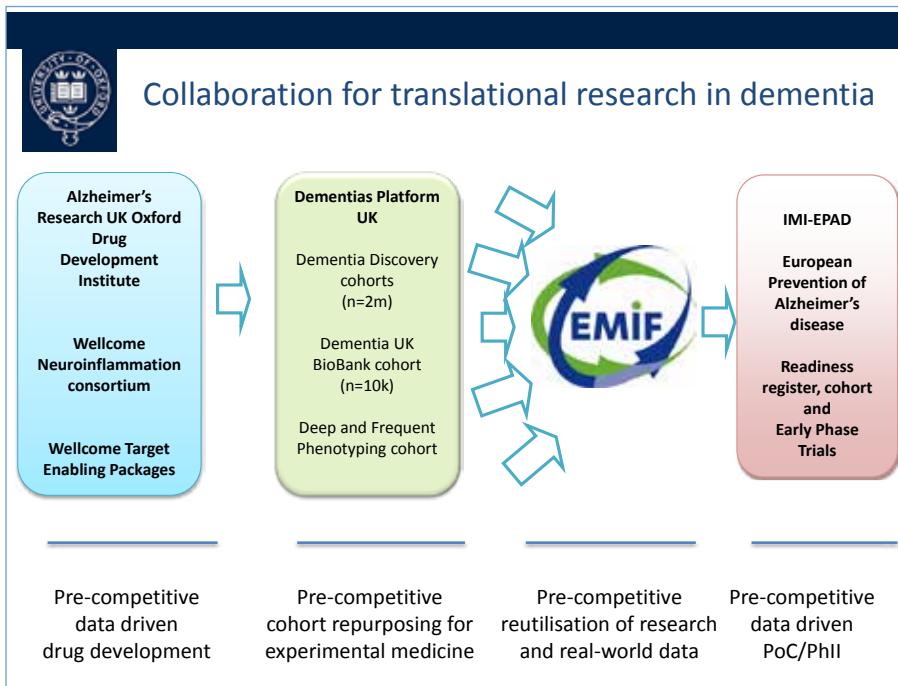
The growing numbers of people with dementia, Alzheimer's disease in particular, presents challenges not only to older people, and to their families, but also to health services and indeed to economies. It's no wonder politicians have made this a priority area for development. Yet, after many years of under-funding, attention is focussed on neurodegeneration. The first trials of putative disease modification therapeutics have reported negative results and drug development looks increasingly difficult in these diseases.

This is a very big problem. Might Big Data provide something of a solution or is it a big, albeit fashionable, distraction?

Some evidence suggests that Big Data – whether derived from biological or from clinical datasets might help progress the search for therapeutic interventions in dementia. Research using informatics as a core component will be described both in the field of molecular biomarkers for clinical trial utility and in turning mechanistic understanding into drug development programmes. Platforms for dementia research utilising large variable datasets – essentially Big Data platforms – will be described including in drug discovery, the Dementias Platform UK and the Innovative Medicines Initiatives – the European Medical Information Framework and the European Prevention of Alzheimer's Disease programme.

Collaboration for translational research in dementia

Alzheimer's Research UK Oxford Drug Development Institute	**Dementias Platform UK**	**IMI-EPAD**
Wellcome Neuroinflammation consortium	Dementia Discovery cohorts (n=2m)	**European Prevention of Alzheimer's disease**
Wellcome Target Enabling Packages	Dementia UK BioBank cohort (n=10k)	**Readiness register, cohort and Early Phase Trials**
	Deep and Frequent Phenotyping cohort	

EMIF

Pre-competitive data driven drug development	Pre-competitive cohort repurposing for experimental medicine	Pre-competitive reutilisation of research and real-world data	Pre-competitive data driven PoC/PhII

Professor Simon Lovestone
Translational Neuroscience,
University of Oxford
simon.lovestone@psych.ox.ac.uk

Digital Innovation in Cardiology Clinical Pathways

Evidence based medicine can be embedded in cardiology pathways using digital media, to the benefit of patients, staff and the wider NHS.

An innovative collaboration can bring the best of the NHS and private sector together to benefit staff & patients. Combining first class care, dedicated staff and medical expertise from the NHS with robust project management and finance from the private sector, it is possible to create sustainable longer term healthcare outcomes.

In my talk I will aim to demonstrate how the use of modern digital technology can and will transform the delivery of healthcare over the next 10 years. I will do this by highlighting specific projects with which I have been involved. For example, Care4Today™ Heart Health Solutions is a new comprehensive cardiac rehabilitation programme. It aims to improve patient outcomes and reduce preventable readmissions by supporting clinical staff and patients.

I will also highlight the importance of collaboration between the NHS and the private sector to ensure that viable projects are delivered on time and on budget. This means that patients reap the benefits earlier.

Finally I will discuss how the NHS could become the place for the life science industry to test out its products.

Dr Piers Clifford
Consultant Cardiologist Clinical Lead for Cardiology, Buckinghamshire Healthcare NHS Trust
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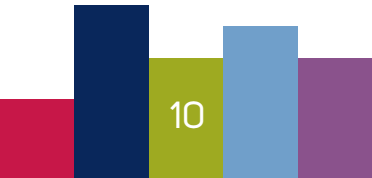
Brainomix –
Improving stroke diagnosis with medical imaging

Brainomix has developed and is commercialising the medical imaging software e-ASPECTS. e-ASPECTS is designed to improve patient selection, thereby increasing the number of patients receiving the life-saving benefits of stroke treatment.

Accurate diagnosis of stroke patients for acute treatment requires fast and reliable identification of early signs of stroke damage on brain computed tomography (CT) scans. However, detection of such signs is challenging even for expert stroke physicians.

Brainomix, a start-up of the University of Oxford, has developed and is commercialising the medical imaging software e-ASPECTS that automatically assesses the extent of early stroke damage on brain CT scans by applying the clinically validated ASPECTS score.
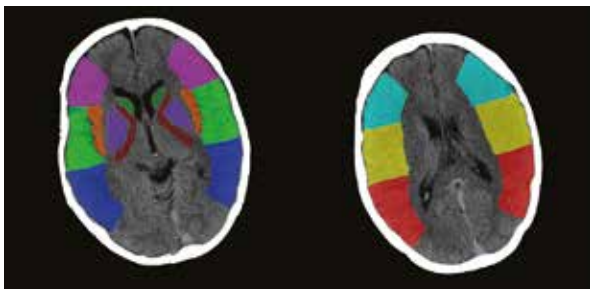
The ASPECTS score measures the extent of early stroke damage on CT scans by assigning a score from 0-10, according to how many brain regions have been damaged by the stroke. e-ASPECTS enables less experienced stroke physicians to quickly and reliably interpret brain CT scans of stroke patients. It integrates seamlessly with existing clinical procedures and is aimed at speeding up decision-making. e-ASPECTS addresses the worldwide lack of readily available expertise in interpreting brain CT scans of stroke patients. It is CE marked software and is as good as an expert physician in identifying early stroke damage on brain CT scans and applying the ASPECTS score. It correctly identifies 97% of patients eligible for stroke treatment and can identify those at high risk of severe side effects caused by treatment.
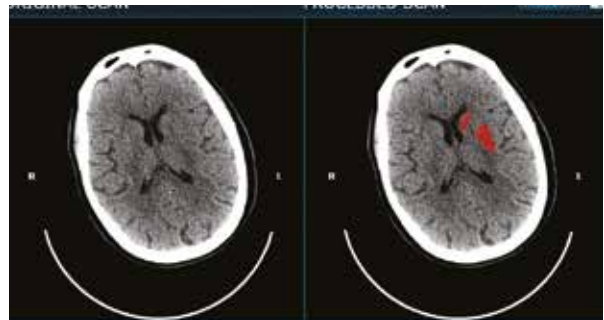
Being fully automated, e-ASPECTS standardises CT scan interpretation, removing any inter and intra-rated variability, inherent to manual assessment. Overall, e-ASPECTS is an important diagnostic tool assisting stroke physicians to assess and interpret early stroke damage on brain CT scans of stroke patients. e-ASPECTS is designed to improve patient selection, thereby, increasing the number of patients receiving the life-saving benefits of stroke treatment.

Dr Michalis Papadakis
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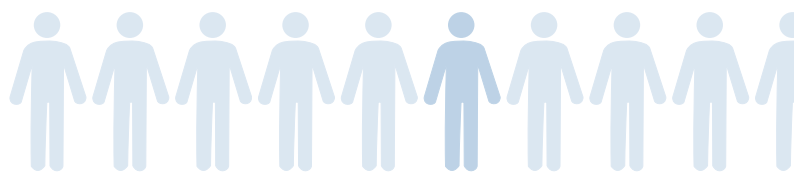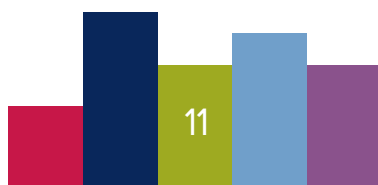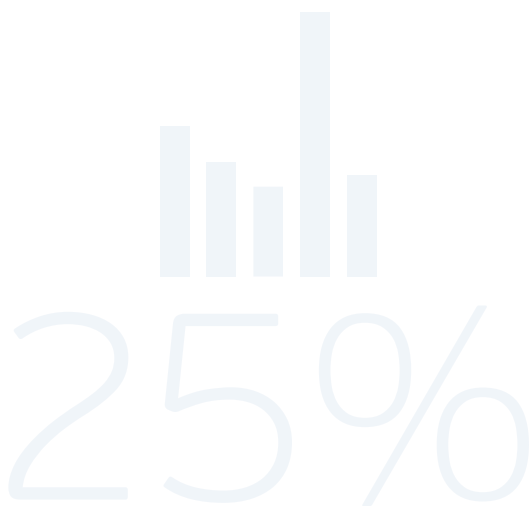
Smart Oxford

Oxford has unique characteristics, including a strong research base and its location within an area of global excellence in terms of research facilities.

The city and the county of Oxfordshire, are very well placed to become the top 'smart city'; a city that develops and deploys technologies to manage itself better than any other city in the world.

The Smart Oxford project will bring to the city of Oxford and to the county of Oxfordshire an enhanced service delivery, a more sustainable environment, enhanced wellness, better security and, critically, a rapidly evolving 'cluster' of companies developing and delivering smart city solutions to the world.

addressing them and for managing the services that underpin the city's quality of life and its attractiveness.

As a brand, Smart Oxford, will aim to attract global investment into Oxfordshire. It is envisaged that not only will jobs be created in Oxford, but also in the surrounding communities. Increased connectivity and enhanced mobility will increase peoples' options regarding where they live and how they work. Similarly, through the collection of better environmental data and its integration into enhanced planning processes it will be possible to enhance the quality

Oxford has already been working on Smart initiatives over the last few years and there are projects already underway that address the city's challenges. However, Oxford is not alone in realising that its economic future will be dependent upon Smart systems. The competition is on and Oxford needs to act now in order to reap the benefits of becoming a global leader in a £200bn market.

Smart Oxford will focus on real issues facing the city; challenges that will be precisely defined by those responsible on a day-to-day and year-to-year basis for

of life for all of those in Oxfordshire and not just the city of Oxford.

Mr Llewelyn Morgan
Service Manager, Localities Policies and
Programmes Oxfordshire County Council
Llewelyn.Morgan@Oxfordshire.gov.uk

Big Data for Population Health

Characterising large datasets can improve our understanding of human disease. Oxford's Big Data Institute will create a major hub for analysing digital healthcare information in new ways.

Martin Landray is Professor of Medicine and Epidemiology within the Nuffield Department of Population Health and Deputy Director of the Big Data Institute within the Li Ka Shing Centre for Health Information and Discovery. Phase 2 of the Li Ka Shing Centre will build on the high throughput biology activities in the Target Discovery Institute (TDI) by creating an Institute directed at obtaining and characterising large datasets to improve our understanding of human disease.

The UK and Oxford are uniquely positioned to lead globally in this new, emerging field of biomedical science. We already have access to very detailed information from large patient cohorts such as UK Biobank, and will ultimately have access to 50 million electronic patient records through the NHS. Plus, there is now much improved surveillance of infectious diseases that enables us to track prevalence and transmission globally. Meanwhile, the phenomenal output from the human genome is providing ever deeper insights into health and disease with large scale sequencing about to become routine. This information can now be digitised and analysed in new ways.

The success of the Big Data Institute will depend heavily on the analytical skills available and the University's Departments of Statistics, Computing Science and Biomedical Engineering are likely to provide many of the capabilities needed to handle and interrogate these very large data sets.

The traction already gained by the TDI with industry collaborators, and the opportunities to initiate a whole new sector of health informatics, diagnostics and clinical decision support through the Big Data Institute, will make the Li Ka Shing Centre a major hub for commercialisation and economic growth. It has the potential to transform our understanding, treatment and management of human diseases.

Professor Martin Landray
Deputy Director,
University of Oxford Big Data Institute
martin.landray@ctsu.ox.ac.uk

Monitoring mood and health via your phone:
True Colours

True Colours helps patients to self-manage and report on mental health disorders, surgery and other conditions. It integrates patient reported outcome measures with data from smartphone sensors.

Easy to use, healthcare self-monitoring

This easy-to-use technology enables people to monitor their health by texting or emailing answers to health-related questions. Answers are recorded and can be viewed online by participants and members of their care team. This record can be annotated with items such as changes in medication, changes in environmental stresses, and behavioural changes.

By monitoring their symptoms patients can learn how to make small changes to their lifestyle that can have a big impact on wellbeing.

NHS and beyond

After 9 years of use – during which the True Colours system has collected over 300,000 patient responses – the system is now being used in NHS Trusts around the country. It helps doctors and patients monitor mood disorders, migraine, ulcerative colitis and surgery outcomes.

Lead developer Dr Chris Hinds says: "Smartphones are widespread, networked, powerful and laden with sensors. Finding biosignatures across multiple sensor streams is consequently more challenging than ever before. These challenges motivated us to consider more open models of collaboration where data scientists and the data providers are decoupled, allowing international competition to accelerate analytic progress.

The kind of research we want to do requires us to engage more participants for longer than ever before. Tracking the course of a disease like dementia will require global cohorts engaging in research for a decade or more. To achieve this we're setting up a federated model, where teams from around the world will contribute research interventions into a single app for comparative testing within a global cohort.
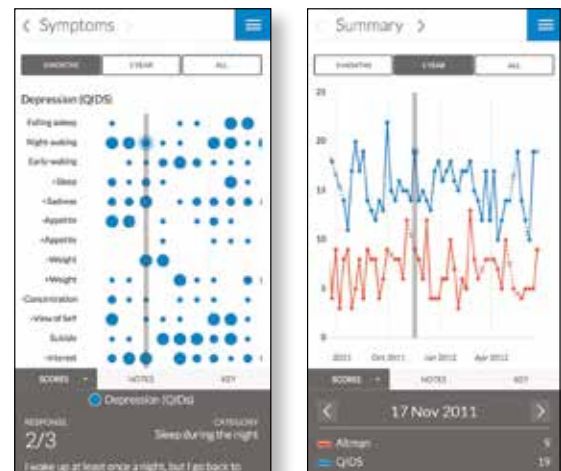
The opportunities afforded by digital health are therefore changing how we view our participants. They are no longer our subjects, to be coaxed toward protocol compliance, but rather our co-investigators, who need to be informed and engaged."

Dr Chris Hinds
Lead Software Developer,
Oxford Institute for Digital Health
chris.hinds@psych.ox.ac.uk

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Digital Health
## for Chronic Disease Management

Two ongoing Oxford-initiated digital health projects will be introduced to demonstrate how digital technologies are being used to tackle very different types of chronic disease challenges.

Digital technologies are thought to radically transform healthcare delivery. In order to leverage their full potential, several challenges must be overcome. We have focused on the need for better understanding of consumer needs as the critical step in designing digital health solutions.

For example, digital health solutions for preventive care that target populations with low perceived healthcare needs are likely to depend on a different approach than those that target people with complex chronic conditions who may suffer from substantial disability.

Two large-scale digital health projects will be introduced which demonstrate how through collaboration and interaction with different stakeholders integrated digital solutions are being designed and how they are being iteratively adapted and evaluated:

• In the SUPPORT-CVD trial, digital technologies are used to inform people about their future risk of cardiovascular disease and to offer proven effective treatments through a quality-controlled network of non-physician healthcare workers.

• At the other end of the spectrum, the SUPPORT-HF has developed technologies that empower heart failure patients with significant disability to manage their condition better at home. It further provides scalable solutions for provision of specialist advice that is based on evidence and timely access to patient-level data.
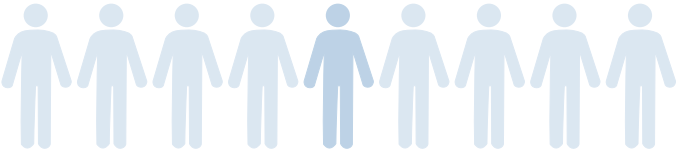
Associate Professor Kazem Rahimi
Deputy Director, the George Institute for Global Health, University of Oxford and Honorary Consultant Cardiologist, Oxford University Hospital Trust
kazem.rahimi@georgeinstitute.ox.ac.uk

Down to Earth

The know-how behind missions such as Rosetta has been successfully translated to a range of terrestrial challenges.

Space2Health is a submission to the STFC Network+ call, for a partnership between The Open University, RAL Space and Oxford AHSN and key stakeholders in the health and space sectors that will provide a roadmap of activities that supports the development of a pipeline of coherent, investor-ready business cases that can leverage future investment for novel and disruptive solutions to challenges in the NHS.

NHS England and the UK Government recognise the need for innovation in healthcare. The NHS Five Year Forward View states "the NHS needs to adapt to take advantage of the opportunities that technology and science gives to patients, carers and those who serve them."

However, they have also concluded that too often technologies have been tested alone in isolation from complementary innovations and how the NHS services are delivered, thus limiting their value. Planetary exploration pushes the boundaries of science and engineering and requires the development of innovative solutions to complex challenges. The know-how and collective expertise to capture the complex requirement specifications and then develop such solutions has already been translated to other sectors.

Two leading planetary and space science groups (Department of Physical Sciences at The Open University and STFC's RAL Space) are co-located within the country's leading health research region. This project will provide the opportunity for space scientists and engineers to engage with the diverse community that are members of the Oxford Academic Health Science Network. Brokered events will result in disruptive solutions that can deliver solutions to unmet needs in the health services in a better way, at scale.

The programme is designed to provide a rich and intensive support environment that allows novel ideas to be generated, captured, packaged and developed,

Ptolemy Team at the Lander Control Centre on Landing Day

through a process of tailored support that is sector specific. Key stakeholders from the health, charitable and the commercial innovation sectors will sit on the steering groups to ensure that the project is focussed on the requirements of the sector and has the best opportunity for follow-on funding and ultimately adoption nationally.

Dr Geraint Huw Morgan FRAS MRSC
Department of Physical Sciences,
The Open University
geraint.morgan@open.ac.uk

Oxehealth –
Disruptive innovation in medical technology

Webcams will lead to new ways of monitoring the health of individuals in the home, especially in the context of telemedicine for the ageing population.

There has been an explosion of wearable technology in the last five years. Wearable devices such as Fitbit have so far been mostly targeted at the wellness consumer market, they have not yet made any impact as medical devices

for tracking changes in the physiology of an individual by measuring their vital signs (physical activity, pulse rate, breathing rate, oxygen levels and blood pressure). Yet with changing demographics in the developed world (the year-on-year increase in the proportion of people above the age of 65), this is a much more important segment of the market for medical devices in the long term.

Building on work in Professor Tarassenko's research lab in the Oxford Institute of Biomedical Engineering, Oxehealth have been developing an alternative, disruptive technology for monitoring vital signs using webcams. This does not require any electrodes or sensors to be attached to the individual. Clinical validation data has been obtained from studies in which webcams were positioned more than a

metre away from the patient, in the Oxford Kidney Unit (during dialysis) and in the Neonatal Intensive Care unit. It is not enough for commercial exploitation, however, to have a disruptive technology which makes it possible to derive physiological data unobtrusively: there have to be applications with markets of sufficient size to drive the adoption of the novel technology.

In the short term, Oxehealth are concentrating on baby monitoring in the home and on the monitoring of at-risk individuals in secure room environments. In the longer-term, the focus will be on telemedicine (two-way video to evaluate, diagnose and treat patients remotely). Telemedicine, a fast-growing technology to help relieve the burden on primary care physicians, has received substantial investment in the US in the last two years. We believe that it will be transformed by the addition of non-contact vital sign monitoring.

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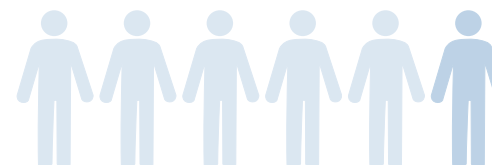
Adoption of Telehealth in Gestational Diabetes Care

Improved management of diabetes during pregnancy with reduced risks to mother and baby and its roll out and adoption through the Oxford AHSN.

Up to 18 in every 100 pregnant women develop diabetes; untreated, this can lead to complications for mother and baby before and after birth. Careful monitoring of mother's blood sugar levels is vital and standard practice is for the mother to record her levels up to six times a day with fortnightly visits to hospital.

Professor Lionel Tarassenko and his team at the University of Oxford have developed a Bluetooth-enabled blood glucose meter and smart phone app (GDm-health) enabling patients to pass on readings in real-time via a secure internet link. Data are reviewed by diabetes specialists who can swiftly connect the patient to treatment if needed. The result is better management and fewer tiring, time consuming and expensive hospital appointments

Benefits to both patient and provider
GDm-health was used in an initial trial with 52 pregnancies led by Dr Lucy MacKillop, Consultant Obstetric Physician at the Oxford University Hospitals NHS Trust.

• Participants rated the technology as reliable, convenient and suited to their life styles.

• A patient commented "it was handy to know that I was in constant touch with somebody, and that I would get a message if there was something to worry about.

• App usage increased efficiency, freeing up 25% more specialist clinical capacity.

• If rolled out nationally, App use could generate cost savings of up to £14m each year.

**Roll out and adoption through the Oxford AHSN**
Oxford AHSN helped the award-winning project, a collaboration between the University of Oxford and Oxford University Hospitals, extend to hospitals in Reading and Milton Keynes. The work was led through the Clinical Innovation Adoption Programme of the AHSN. Others are following suit.

A randomized controlled pilot trial involving 200 patients is underway with funding from the NIHR funded Oxford Biomedical Research Centre.

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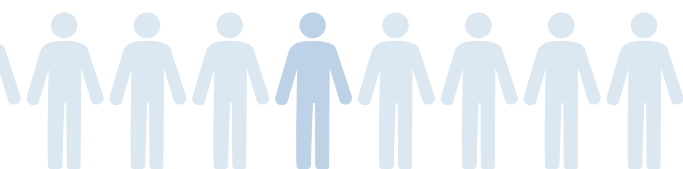
Diagnosis of rare diseases with computational analysis of photographs

Dr Christoffer Nellaker and his team at Oxford's Department of Physiology Anatomy and Genetics are developing computer vision algorithms to automatically analyse photographs of faces for disease-relevant phenotypes.

The approach will aid clinicians to narrow the search space to find the correct diagnosis for rare diseases.

Genetic disorders affect almost 8 per cent of people, about a third of whom will have symptoms that greatly reduce their quality of life. There are over 7,000 known inherited disorders and the path to diagnosis is often very difficult.
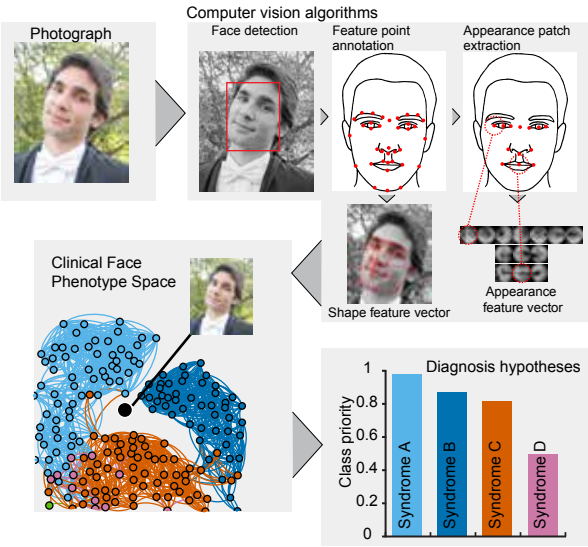
Clinical dysmorphology is a key discipline within clinical genetics which requires an enormous breadth of experience to correctly classify and diagnose ultra-rare diseases.

The team are applying computer vision research to enable analyses based on ordinary photographs to be performed for the purpose of detecting disease phenotypes.

They have developed Clinical Face Phenotype Space, an algorithm which will automatically detect faces in photographs, annotate locations of key anatomical parts and extract machine readable feature descriptions of the facial gestalt.

The approach uses machine learning to create a multidimensional space shaped to account for spurious variations such as lighting, pose, occlusions, and image quality. The Clinical Face Phenotype Space algorithm locates patients in the context of known syndromes, and can help to generate disease hypotheses.

Above: automatic average faces from six of the different syndromes used in training the Clinical Face Phenotype Space algorithms

With Clinical Face Phenotype Space, the team are aiming to create an impartial means of narrowing the search space to suspected rare diseases. This could augment the prioritisation of testing in clinical investigations and allow the clustering of patients by phenotype even when no known syndrome diagnosis exists, aiding disease identification.

The team:
Mohsan Alvi, Department of Engineering Science
Quentin Ferry, DPAG
Julia Steinberg, DPAG
Caleb Webber, DPAG
David R FitzPatrick, University of Edinburgh
Chris Ponting, DPAG
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Expert Panel Speaker Biographies

Professor Lionel Tarassenko

Professor Tarassenko is the author of 170 journal papers, 180 conference papers, 3 books and 27 granted patents. He has been a founder director of four University spin-out companies, the latest being Oxehealth in September 2012. He was the Director of the University of Oxford's Institute of Biomedical Engineering from its opening in April 2008 until October 2012. He is the Bioengineering theme leader for the joint NHS/University of Oxford Biomedical Research Centre, a non-executive director of Isis Innovation, and has been the Director of the Oxford Centre of Excellence in Medical Engineering jointly funded by the Wellcome Trust and EPSRC since October 2009.

Prof Lionel Tarassenko CBE FREng FMedSci
Head of Department of Engineering Science,
University of Oxford
Founder Director, Oxehealth

Professor Martin Landray

Martin Landray is Professor of Medicine and Epidemiology within the Nuffield Department of Population Health and Deputy Director of the Big Data Institute within the Li Ka Shing Centre for Health Information and Discovery.

His work seeks to further understanding of the determinants of common life-threatening and disabling diseases through the design, conduct and analysis of efficient, large-scale epidemiological studies (including clinical trials) and the widespread dissemination of both the results and the scientific methods used to generate them.

He is heavily involved in streamlining clinical trials, working with the FDA, EMA, MHRA and MRC, to facilitate high quality research that is efficient in providing robust information for healthcare decision-making. He is a member of the Steering Committee of the Clinical Trial Transformation Initiative (an FDA initiative, coordinated by Duke University) and a leader of the CTTI Monitoring and Quality by Design Projects.

Professor Landray continues to practise clinical medicine as an Honorary Consultant Physician in the Cardiology, Cardiac and Thoracic Surgery Directorate at Oxford University Hospitals NHS Trust. He is a Fellow of the Royal College of Physicians of London, the Higher Education Academy, the American Society of Nephrology, and the British Pharmacological Society.

Professor Martin Landray
Deputy Director
University of Oxford Big Data Institute
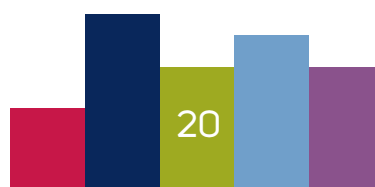
Expert Panel Speaker Biographies

Professor Jim Davies

Jim Davies is Professor of Software Engineering at the University of Oxford, Director of Informatics for the Oxford NIHR Biomedical Research Centre and the NIHR Health Informatics Collaborative, and Chief Technology Officer of Genomics England Limited. He is leading informatics development for translational research programmes in cancer and microbiology. His research interests include the development of metadata- and model-driven tools for electronic governance and health informatics.

Professor Jim Davies
Professor of Software Engineering,
University of Oxford;
Director of Informatics, Oxford NIHR
Biomedical Research Centre and the NIHR
Health Informatics Collaborative;
Chief Technology Officer of Genomics
England Limited

Dr Ben Goldacre

Ben Goldacre is a doctor, academic, campaigner and writer whose work focuses on uses and misuses of science and statistics by journalists, politicians, drug companies and quacks. His project at Oxford University aims to improve the transparency and reliability of clinical trials in medicine and randomised experiments in social policy. Originally trained in medicine in Oxford and London, Ben has recently co-founded the AllTrials campaign with Oxford University's Centre for Evidence-Based Medicine, the BMJ, Cochrane Collaboration, James Lind Alliance, PLOS and Sense about Science. He is also the founder and director of BetterData, a non-profit organisation building fun projects to create and use data more effectively in healthcare and academia.

Dr Ben Goldacre
Senior Clinical Research Fellow
Department of Primary Care Health Sciences
University of Oxford

Ms Tracey Marriott

Tracey Marriott is the Director of Clinical Innovation Adoption at the Oxford AHSN, responsible for implementing the adoption of new technologies at scale and pace within the region. She is a Henley Management MBA qualified transformational change professional with extensive experience of delivering complex programmes both nationally and within the Oxford AHSN region. She works closely with the Oxford AHSN Best Care Clinical Networks and Commercial Team, service providers, NHS Commissioners and suppliers for innovation implementation.

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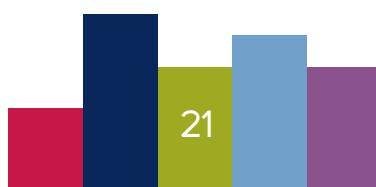
Other Organisations Exhibiting

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www.ox.ac.uk/research/innovation-and-partnership

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www.stfc.ac.uk

Digital Health Oxford

Digital Health Oxford is a cross-disciplinary, cross-sector group that promotes and supports digital health in Oxford, and beyond.
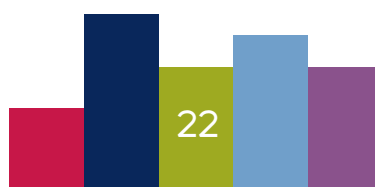www.dhox.org

White October

White October is a digital agency and works unusually closely with clients to design, develop and build digital products such as apps and websites.
www.whiteoctober.co.uk

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