INNOVATION insights

THE LATEST INNOVATIONS, COLLABORATIONS AND TECHNOLOGY TRANSFER
FROM OXFORD UNIVERSITY INNOVATION

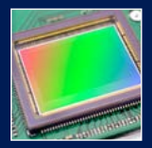
ISSUE 5 JANUARY 2017

IMPACT FROM RESEARCH

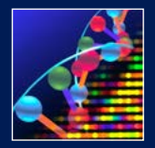
Focus on the humanities and social sciences ▶

Biophysical assay for tethered enzymatic reactions ▶

Anti-inflammatory drugs from ticks ▶



CMOS image sensing at low light intensities ▶



Genotype calling and phasing software ▶

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Innovation in all its flavours

In universities worldwide there is growing demand, and assistance, to nurture an entrepreneurial culture, and encourage development of innovative ideas from researchers' notebooks to the benefit of wider society. Nowhere is this more true than in arts faculties which by their nature are concerned with the culture and environment in which we live.

One of Oxford's many strengths is the wealth of knowledge, vision and expertise of researchers in the Humanities and Social Sciences Divisions. We are learning, together, how the expertise within a technology transfer office can ensure that research from these divisions is supported just as effectively as that from the 'hard' sciences. In this edition, we highlight an Innovation Challenge competition in the Humanities Division, and a new brochure including examples of our work with the Social Sciences Division.

With progress like this, the time may be coming when OUI and its peers have to stop describing ourselves as Technology Transfer Offices.

Linda Naylor, Managing Director

Linda has announced her intention to retire from Oxford University Innovation in April 2017, having joined the company in 2002, and leading it in the interregnum preceding the recent appointment of Dr Matt Perkins as CEO.

News

The most prolific university innovator in Europe
Oxford University Innovation, the research commercialisation company for Oxford University, set a new record in spinout generation for the UK and Europe in 2016.

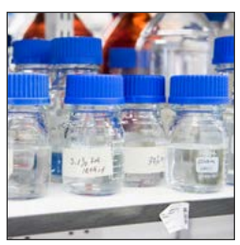
FULL ARTICLE ▶

OxSonics raises £9.4m in series B equity financing
2014 spinout Oxsonics has secured investment to fund development of SonoTran, its drug delivery platform, for the enhanced delivering of oncology agents to solid tumours.

FULL ARTICLE ▶

VR platform used for health education
Gamification healthcare training platform, LIFE, has developed into a virtual reality (VR) education platform to educate healthcare workers in developing countries on infant resuscitation techniques.

FULL ARTICLE ▶



Accelerating Oxford drug discovery
Public-private drug discovery partnership, LAB282, will provide funding and expertise to aid the research outputs in new drug discovery and new treatments and cures for serious and debilitating disease.

FULL ARTICLE ▶

Oxford University spinout receives seed funding
PrOXisense, currently working with Rolls Royce and Alstom to further develop its proximity sensors for turbine blades, has secured £330,000 at launch in seed funding.

FULL ARTICLE ▶

New refinery technologies for improved gasoline production

Fluid catalytic cracking (FCC) is a crucial component of the refining of crude oil. It provides for the conversion of long-chain hydrocarbons into the gasoline and chemical precursors used across many industries such as fuels, plastics and lubricants.

As part of an international collaboration, Oxford scientists have developed platform technologies for the improved processing of FCC gasoline. These processes provide for lower energy consumption in processing and the recovery of high value chemicals alongside the increase of premium gasoline production, thereby minimising waste and energy input during the refining of oil.

VISIT SITE ▶

Surviving the ever changing digital landscape

We are living in a digital age where the only constant is change. But disruptive technology goes further than incremental change-shaking up entire industries or creating new ones. These innovators need a new breed of lawyer to guide them. Lawyers that understand the challenges ahead and can navigate through an increasingly regulated world.

Hogan Lovells' new Tech Hub is focused on working at the cutting edge of technology. We are a team of M&A, IP/IT, commercial and regulatory experts working collaboratively across disciplines and across industries. We work for the world's most innovative companies, from spinouts to multinational technology companies. Our lawyers constantly monitor new technological trends, tracking developments to understand how these will be impacted by law and regulation.

Whether you are interested in 3D printing, blockchain, the Internet of things (IoT) or immuno-oncology, our lawyers share your drive to change the world in which we live.

For information about Hogan Lovells' Tech Hub please contact richard.diffenthal@hoganlovells.com; paul.joukador@hoganlovells.com or sarah.turner@hoganlovells.com

Read more on our commitment to innovation here ▶

Visual tracking of 3D objects

Video processing methods that enable real-time image segmentation and tracking of 3D objects are in demand for applications in computer vision. Whilst systems that are able to perform these tasks accurately do exist, they are plagued by sluggish processing which precludes real-time applications.

Oxford researchers have developed software that implements a novel algorithm, enabling 3D objects to be tracked in real-time and without the need for additional infrastructure. This technology will enable low-cost applications of 3D tracking to be realised in fields such as augmented reality and robotics.

FULL WEB PROFILE ▶

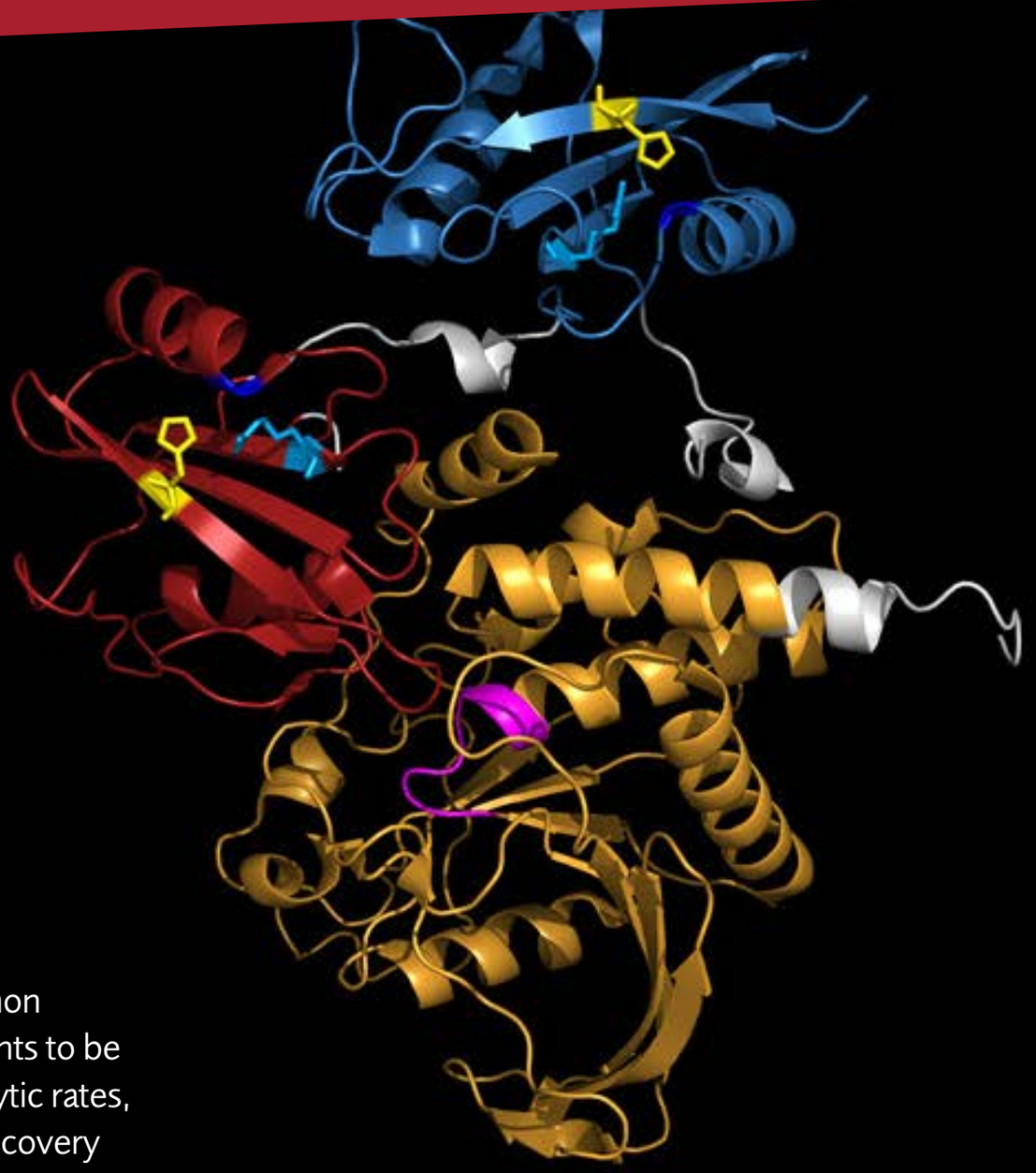
Equality and diversity in Oxford

The Oxford Innovation Society meeting and dinner was held in September at Merton College, with an equality and diversity theme. After an introduction from Linda Naylor, our Managing Director, Professor Helen McShane, Professor of Vaccinology at Oxford University, chaired an expert panel discussion on 'Power in Diversity'.

Speakers and panelists included Professor Harish Bhaskaran, Professor of Applied Nanomaterials at Oxford University & Bodle Technologies; Nicola McConville, Partner, Penningtons Manches LLP; Sue Staunton, Partner, James Cowper Kreston; and Ms Riham Satti, CEO of MeVitae. Each speaker gave a personal account of their views on equality and diversity in the University, commercial working environments and the wider world.

VISIT SITE ▶

Biophysical assay for tethered enzymatic reactions



Tethered enzymatic reactions play a crucial role in cell signalling, which is important in development, tissue repair, immunity, and normal tissue homeostasis. However, the study of such reactions is currently limited by a lack of assays that provide accurate information on rate constants and other fundamental parameters.

Oxford researchers have developed a novel biophysical assay based on Surface Plasmon Resonance (SPR). The Oxford technique allows 5 biophysical and biochemical constants to be obtained with excellent accuracy from a single SPR trace: two binding rates, two catalytic rates, and a tether reach parameter. This technology has applications in commercial drug discovery programmes and as a general research tool.

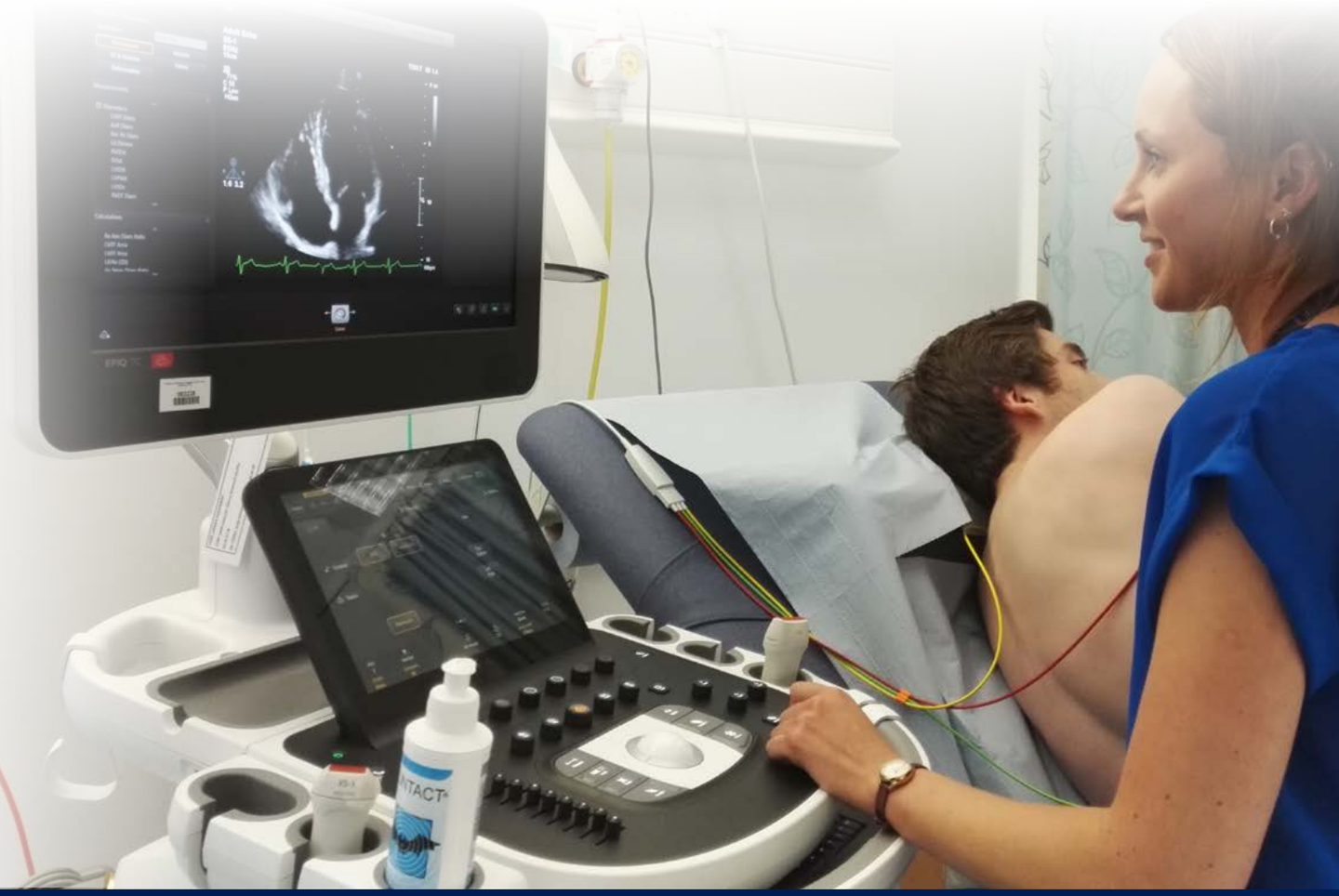
FULL WEB PROFILE ▶

Next generation echocardiography

Echocardiography is the most common imaging tool in cardiovascular medicine, used to assess thousands of patients' hearts every day throughout the world. However, while ultrasound images are rich in data, current methods are limited to analysing only a fraction of the information available.

Ultromics' developers have taken the novel approach of utilising machine learning to mine their archives of echo images to identify key biomarkers of cardiovascular disease. This automated and quantitative approach is hardware and software agnostic, and has demonstrated improved accuracy compared to a consultant's diagnosis. Ultromics software has the potential to assist clinicians in making the correct decisions faster, leading to improved patient outcomes.

VISIT SITE ▶



Anti-inflammatory drugs from ticks

Inflammation plays a central role in a number of chronic diseases creating a substantial disease burden and unmet medical need. The chemokine network is a well-validated target in chronic inflammatory disease. The evolutionary 'arms race' in over 900 tick species has resulted in the creation of a diverse and sophisticated arsenal of anti-inflammatory peptides in tick saliva. One class of peptides, known as "Evasins," suppress chemokine-driven inflammation.

Oxford researchers have identified 31 novel evasins from 8 different species of ticks using a novel yeast display technology. These evasins bind distinct groups or subsets of chemokines with high affinity and neutralise their function. These novel evasins, either singly, or in combination, could be used to precisely target pathogenic chemokines that are expressed in inflammatory diseases.

FULL WEB PROFILE ▶

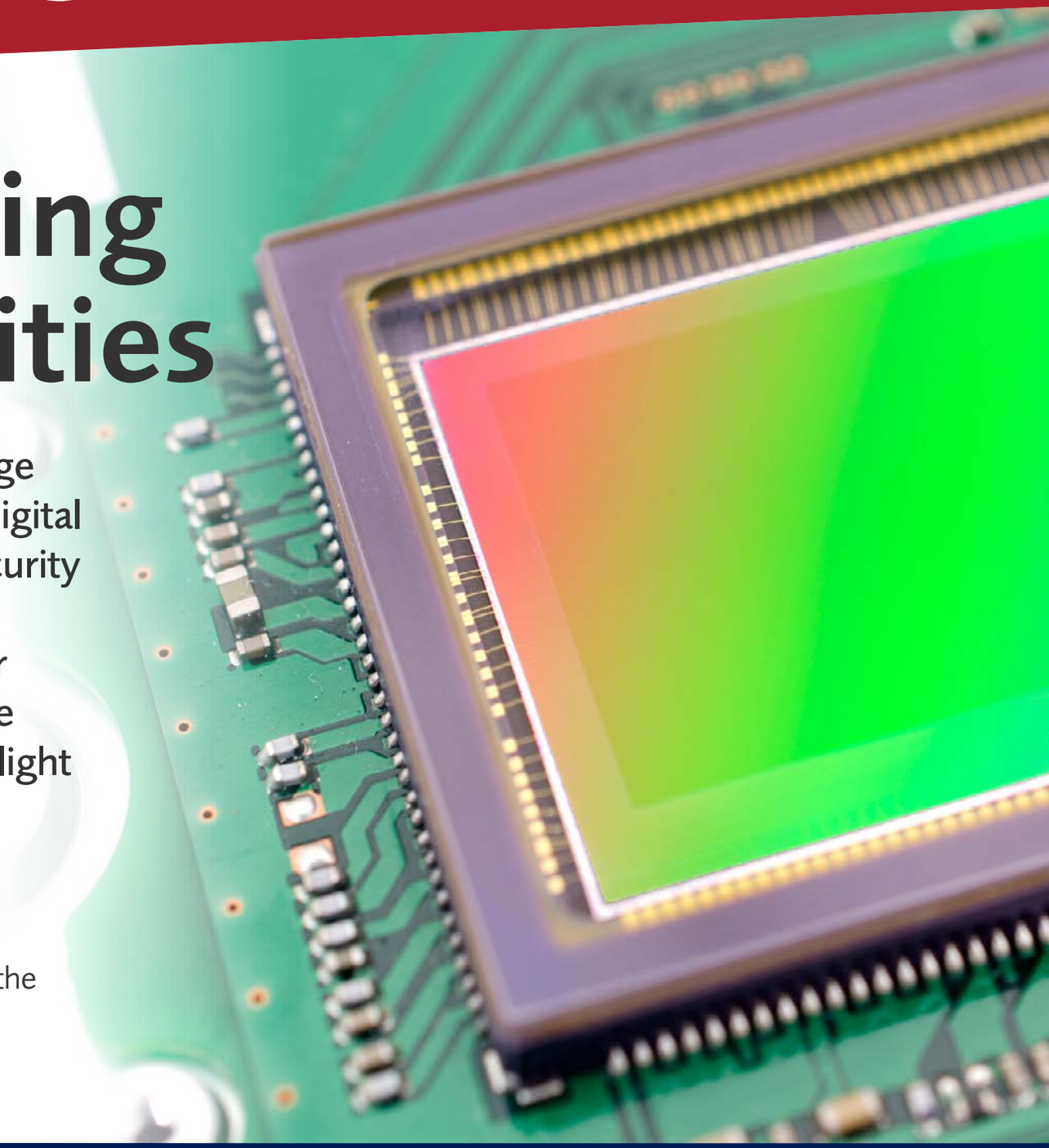
Internal olefins – global demand

Internal olefins are high value chemicals with applications in oil drilling, lubricants, agrochemicals, and surfactants. However, these applications are yet to be fully realised due to the relative scarcity of internal olefins compared with the less advantageous terminal olefins.

Oxford researchers have developed a novel photocatalytic process for the isomerisation of terminal olefins to high value internal olefins. The low cost Oxford process offers exceptional conversions under mild conditions with no added solvent or product contamination.

FULL WEB PROFILE ▶

CMOS image sensing at low light intensities



CMOS (Complementary Metal-Oxide Semiconductor) image sensors can be found in a range of applications including digital cameras, medical imaging devices, satellite images and security systems. The development of CMOS sensors offers both increased integration capabilities and cost advantages over the more established CCD (Charge-Coupled Device) image sensors. However, the sensitivity of CMOS sensors in low light conditions requires significant improvement.

Oxford researchers have developed a new circuit design, which provides exceptional performance at very low light levels and a wide dynamic range. Performance enhancements are independent of manufacturing method, and the new circuit is compatible with existing technologies.

FULL WEB PROFILE ▶

Supporting international entrepreneurs

Over the past three years, the Royal Academy of Engineering Leaders in Innovation Fellowships (LIF) programme has benefited from Isis Enterprise (IE) expertise. The (LIF) programme, attended by researchers (Fellows) from partner countries of the Newton Fund, delivers tailored training in entrepreneurship and innovation leadership to Fellows who wish to commercialise their research.

IE have helped to provide training in business modelling, leadership, finance, Intellectual Property, marketing and regulation, educating Fellows from the different Newton Fund nations on how to present their technologies and pitch to investors. Following each residential round of training, the IE coaches and wider team have continued to work with the Fellows remotely, supporting them as they develop their skills and ultimately progress their projects and companies into success.

ROYAL ACADEMY OF ENGINEERING
LEADERS IN INNOVATION FELLOWSHIPS

More information about IE's activities in supporting entrepreneurship is available here ▶

Detection of liquids on surfaces

Injuries caused by slips and falls due to a wet surface account for a large proportion of common injuries. For example, the Health and Safety Executive estimate that 35% of major injuries in the food and drinks industries are caused by slipping on a wet surface. Typically, warnings relating to spilt liquids take the form of signage placed in the immediate vicinity. However, this relies on the availability of appropriate signage and on the spillage being noticed before an accident occurs. Spilt liquid is not always readily visible, particularly in the case of transparent liquids, and the current solution is unable to alleviate this risk.

Oxford researchers have developed a method for detecting the presence of liquid on a surface and automatically displaying a warning, removing the requirement for human intervention. This invention could be applied to any situation where the presence of spilt or collected liquid could create a hazard.

FULL WEB PROFILE ▶

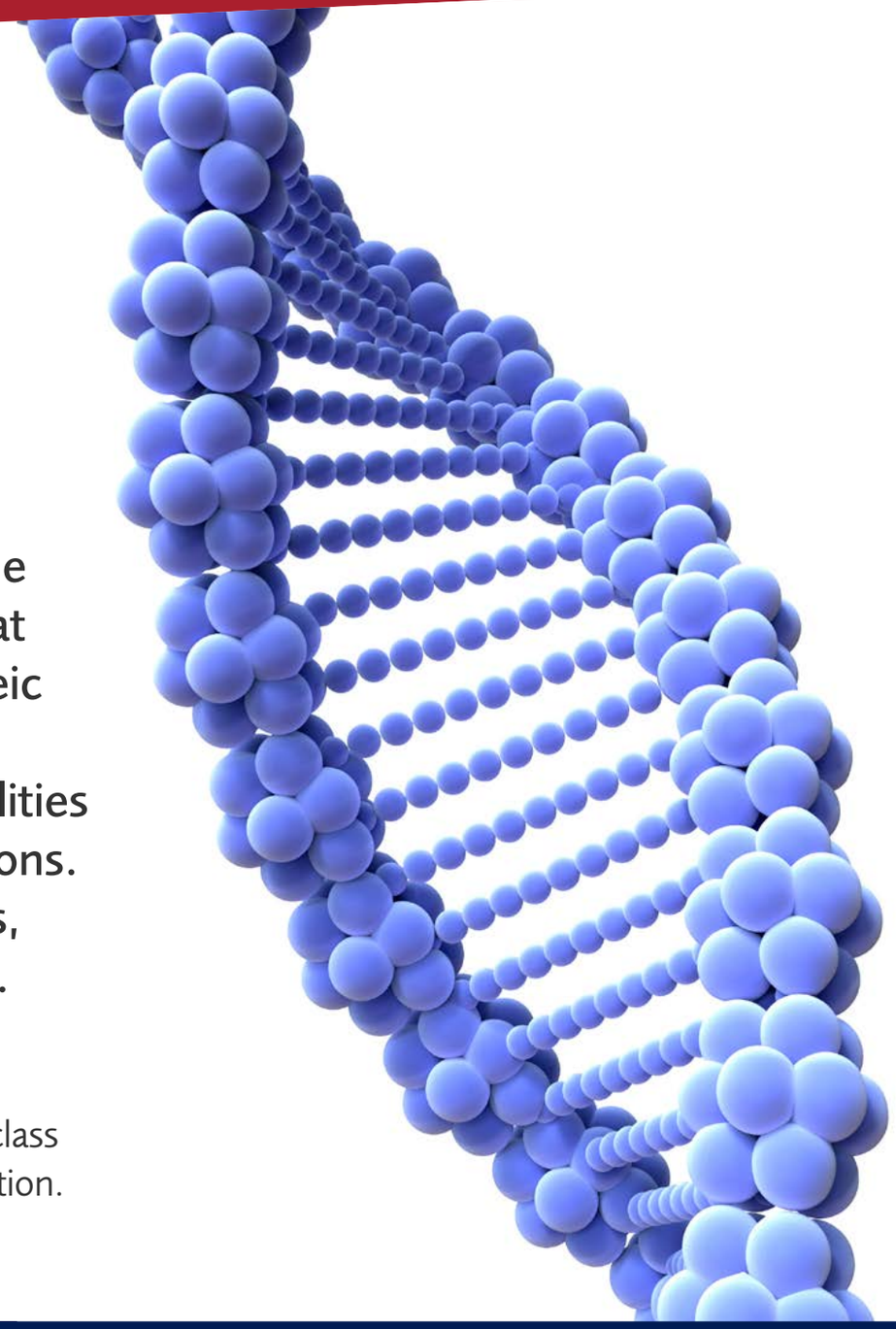
Mexican superfood wins Humanities Innovation Challenge

The Oxford Research Centre in the Humanities (TORCH) and Oxford University Innovation organised the first Humanities Innovation Challenge. The competition was open to researchers, students and staff to propose innovative ideas which could lead to entrepreneurial activity, social impact or enterprise.

A shortlist of 18 entries was narrowed down to 5 for the final pitching session. The winner, Azure, a startup founded by Dr Alexandra Littaye, Research and Development Associate at Smith School of Enterprise and the Environment, is looking to position itself as the first and main distributor of pinole, a traditional Mexican superfood food, in the UK.

VISIT SITE ▶

Designer peptide nucleic acids



Recognition between complementary nucleic acids can occur via Watson-Crick base pairing, these interactions form the basis of the DNA double helix. The specificity of this recognition suggests that nucleic acids could have numerous applications in genetics, nucleic acid sequence detection and in the control of 3D architectures in nanotechnology. However, "natural" nucleic acids offer low-stabilities and binding affinities, making them unsuitable for these applications. Further research has led to the synthesis of Peptide Nucleic Acids, which has resulted in improved structures with greater suitability.

Oxford researchers have now developed novel Pyrrolidinyl Peptide Nucleic Acids; Synthetic nucleic acid analogues with enhanced binding properties and stability. This class of compounds can be applied directly, or considered as a platform for further modification.

FULL WEB PROFILE ▶

A high-sensitivity method for analysis of chromatin structure

Scientists at the University of Oxford have greatly improved a method for exploring the spatial organisation of chromatin in the cell nucleus. Capture-C, previously developed by the same group, is designed to look at chromosome conformation with the use of oligonucleotide capture technology. This high-throughput technique allows researchers to identify genomically distant DNA sequences that come closely together and form interactions through spatial rearrangements of chromatin.

Such sequences commonly include genes and their regulatory elements. Next Generation Capture-C is more efficient and easier to apply than the previously developed method. Additionally, it provides unprecedented levels of sensitivity and reproducibility, and can be used to study many genetic loci and samples simultaneously.

FULL WEB PROFILE ▶

Supporting social sciences

Oxford University Innovation has a growing portfolio of projects with the Social Sciences Division, from consultancy, startups and new ventures and licensing.

A range of projects, from data mapping to educational software, is described in a new brochure on our website. VISIT SITE ▶

To encourage entrepreneurial activity, we are also sponsoring the IDEA IDOL 2017 Competition. This is Oxford's premier 'Dragon's Den' style competition, proudly organised by Oxford Entrepreneurs.

We are keen to encourage researchers, graduate students and staff to pitch their startup ideas to investors and industry leaders.

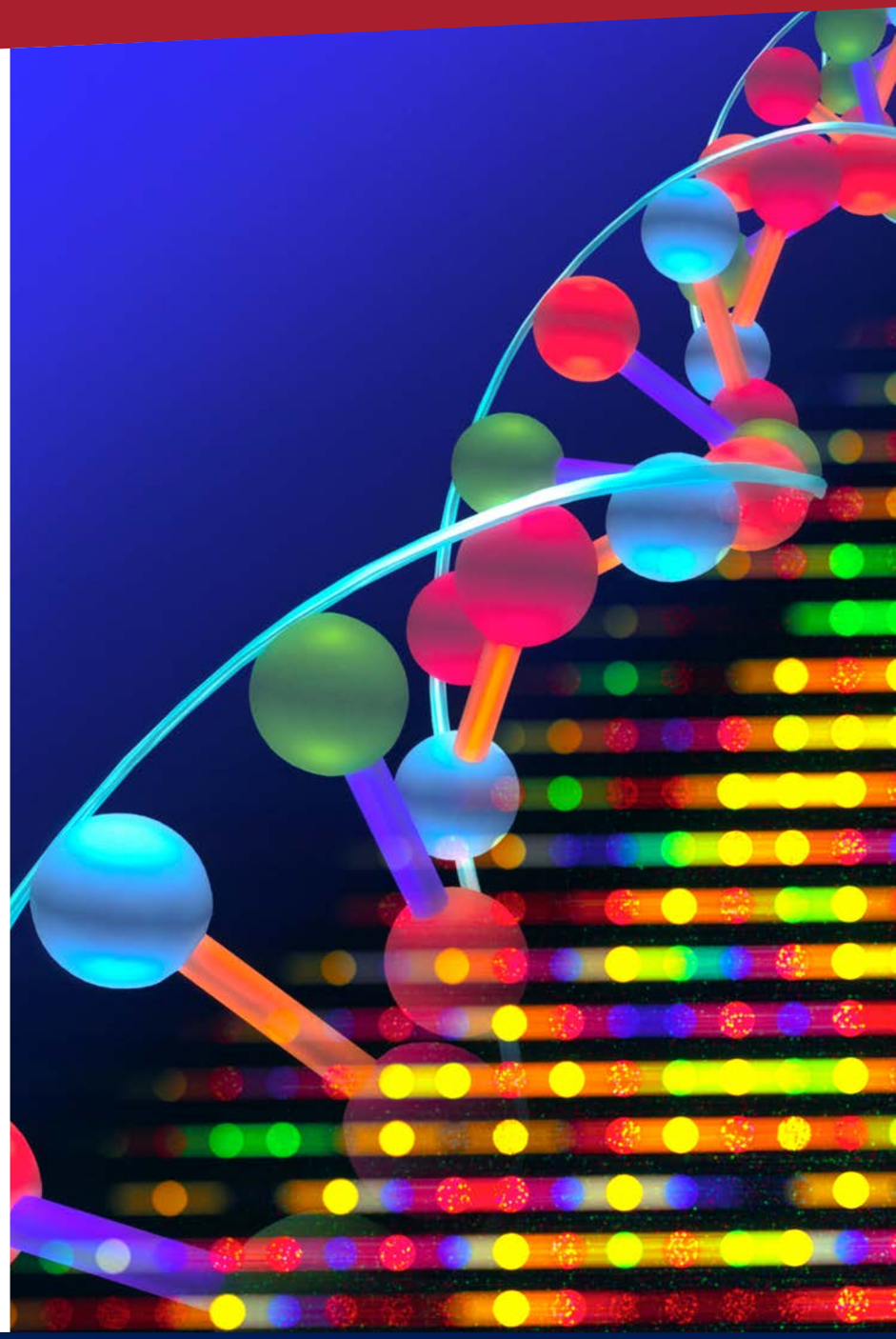
Read more about the competition at: www.idea-idol.com

Genotype calling and phasing software

Genome sequencing is an essential tool when investigating hereditary diseases. The current cost of next-generation sequencing (NGS) constrains large studies to perform low-coverage sequencing, followed by using methods that leverage linkage disequilibrium to infer genotypes.

MVNCall, proprietary software from the University of Oxford, provides an analytical method that assumes study samples are sequenced at low-coverage and then genotyped using a genome-wide microarray. MVNCall can call genotypes at specific sites of interest using a method that is fast, scalable, and highly parallelisable. The implemented approach captures allelic frequency and linkage disequilibrium information for each locus. This proprietary software has proven efficacy, having previously been used to analyse the Phase 1 dataset from the 1000 Genomes Project (Menelaou and Marchini, 2012).

FULL WEB PROFILE ▶



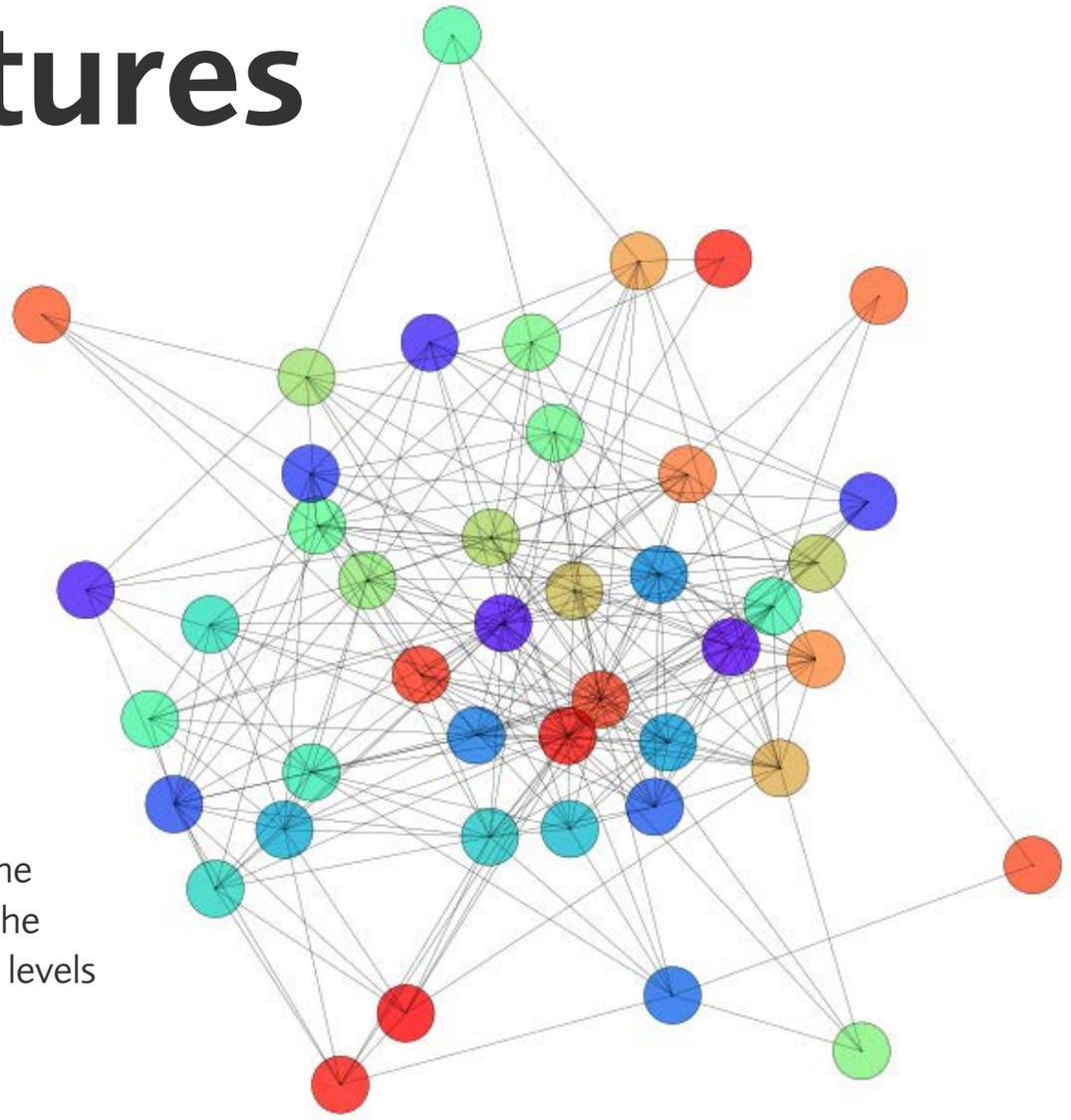
Complement alternative pathway inhibitor

The role of the complement system in various human diseases has become increasingly well understood and a number of drugs that inhibit the complement cascade have already reached the market or are in development. These include Alexion Pharmaceuticals' Soliris® (eculizumab), which recorded net product sales of over US$2.6bn in 2015.

Researchers at Oxford have identified and applied for a patent in respect of a novel tick-derived polypeptide inhibitor of a key step in the alternative pathway, which represents an important therapeutic target for a number of complement-mediated diseases. Oxford University Innovation is now seeking a commercial partner to develop to market this new alternative pathway inhibitor under an appropriate licence agreement.

FULL WEB PROFILE ▶

Visualise essay structures



Distance learning through online courses is an increasingly important component of both personal and executive education programmes. This has an enormous public benefit through increasing access to educational resources and content. Despite the progress in educational technology and online programmes, human tutors are still required to provide feedback to students on written coursework. This is not economically or logistically feasible on the global scale at which such courses operate. Methodology that enables useful feedback to be generated automatically is, therefore, in substantial demand.

Oxford researchers have developed software that provides students with feedback on the structure of written essays. The feedback is quick and simple to interpret, and the form the feedback takes has its basis in educational theory. This software is applicable to different levels of written sophistication and across a variety of genres and writing styles.

FULL WEB PROFILE ▶

What can TTOs do to draw from humanities and social sciences research?

Since they first came into being, University Technology Transfer Offices (TTOs) have more or less solely focused their efforts on commercialising Science, Technology, Engineering and Mathematics (STEM) research outcomes. Yet, in doing so, TTOs are likely missing potentially valuable opportunities to commercialise research from humanities and social sciences.

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INNOVATION insights

There are several factors that explain why research from the humanities and social sciences has not been routinely commercialised. For example, the majority of TTOs' organisational structures and recruitment policies are aimed at managing patent portfolios with a focus on scientific inventions, giving TTOs an inherent bias towards STEM over other parts of the university.

However, the main reason may be found in the different types of intellectual property that are generated by researchers from these disciplines.

The normal commercialisation pathway for inventions from STEM subjects usually involves the filing of a patent application, development of the technology through translational funding, followed by licensing or assignment of the intellectual property rights to an existing company or newly formed spinout company for further development towards the market.

CONTINUED ▶

Conversely, the nature of research in humanities and social sciences does not often lend itself to patenting. Technologies emerging from STEM areas are well served by patenting, whereas ideas springing from humanities and social sciences are less tangible, and more nuanced. Therefore, the "standard" model of research commercialisation does not fit humanities and social sciences.

Despite this, TTOs may have an opportunity to expand their range of services to provide more support for researchers in this area. In addition, the impact agenda from the Research Excellence Framework (REF) has given TTOs an imperative to support the impact that can be generated from research in the social sciences and humanities.

In a move to harness the innovative output of humanities and social sciences, Oxford University Innovation (OUI) has recently conducted a review, which summarises efforts and changes being made by a number of universities to increase support for researchers from the humanities and social sciences that wish to commercialise their research.

The review of current practice was conducted through searching the relevant literature, and conducting a series of interviews with TTOs in the UK and overseas. In conducting this exercise, OUI intended to gain both an overview of best practice from thought-leaders in the area and insight into the thinking of TTOs in the process of expanding their services.

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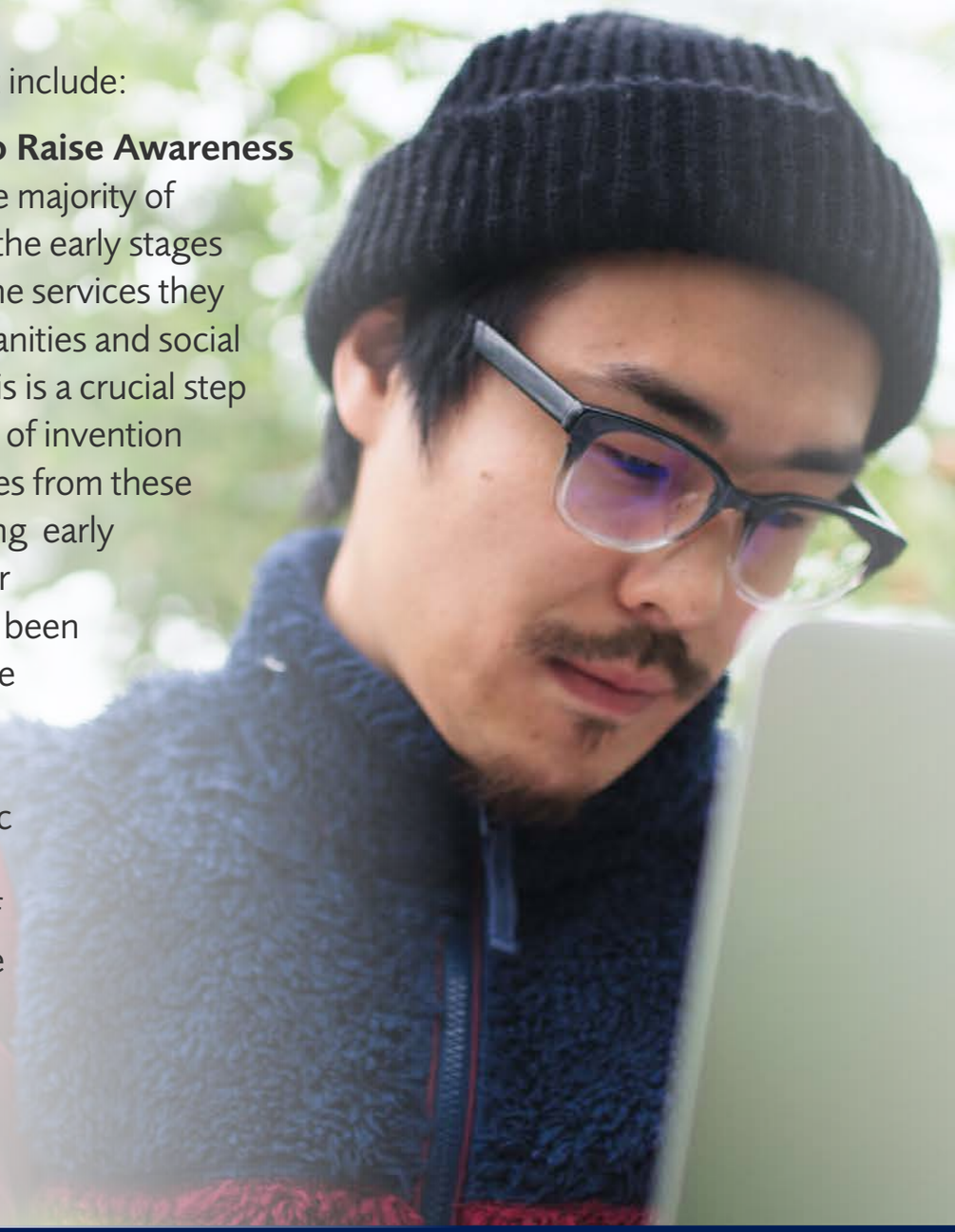


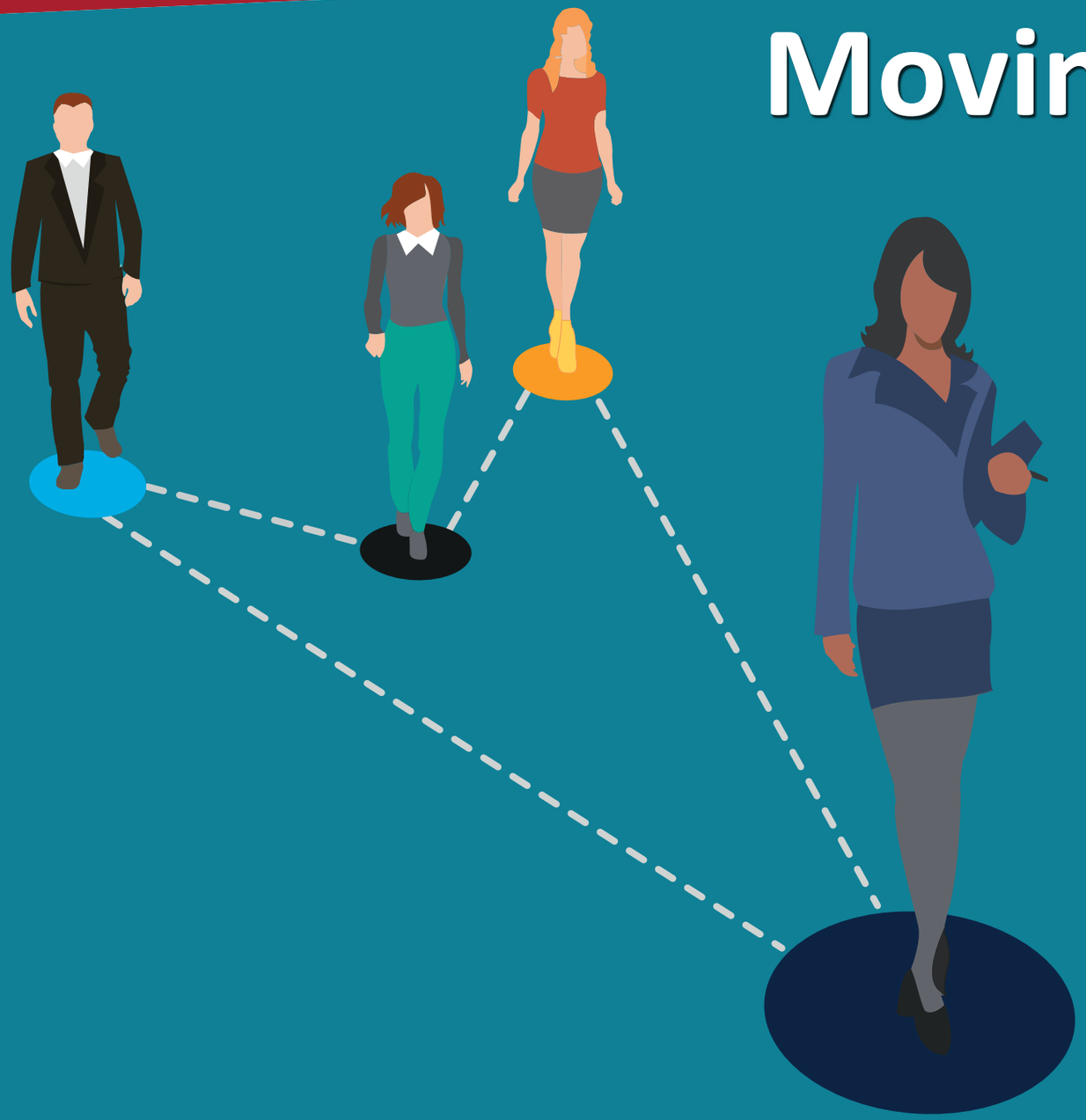
Key findings from the report include:

- **Celebrating Success to Raise Awareness -** The report finds that the majority of TTOs interviewed are in the early stages of raising awareness of the services they can provide among humanities and social sciences researchers. This is a crucial step in increasing the number of invention disclosures a TTO receives from these disciplines, and generating early success stories for further internal marketing. It has been observed that the positive effect of a small number of success stories can greatly increase academic engagement, thus increasing the number of disclosures that TTOs are able to select from.
- **Online Licensing Platforms -** The report identifies a number of innovative practises that certain TTOs have adopted in order to achieve commercial success in this nascent area. Online licensing platforms which enable customers to obtain standard licenses to software or materials have been used to good effect in the commercialisation of humanities and social sciences research. For example, they have been used to provide access to educational resources and software for the analysis of human communication.
- **Targeted Facilities and Infrastructure -** Other notable developments include the development of infrastructure to provide an environment more conducive to innovation in the social sciences. For example, social sciences parks will offer the benefits that a science park offers STEM researchers, access to facilities and proximity to potential commercial partners.

CONTINUED ▶

- **Lower Revenue Expectations and Non-Traditional Licensing Models -** A number of TTOs have described taking a "less commercial" approach when considering these projects. This could encompass low-cost, standard licensing packages to increase access to research outcomes, or considering non-typical licensees, such as NGOs or social enterprises.
- **Funding Structures -** The report also explores the way in which university TTOs can provide a supportive environment and funding structure for social enterprises. Certain partnerships have been particularly successful in this regard. University TTOs have used funding from sources such as UnLtd and HEFCE to develop incubators tailored for social enterprises, either student or academic led. This is an area in which a large number of universities could be providing more support for their academics, whose research could make a significant social impact through a social venture.
- **Terminology -** Referring to the process as "Technology Transfer" may be a barrier to engagement with researchers in non-STEM fields, who may not consider their diverse research to constitute technology. Adopting more inclusive terminology, as many TTOs are beginning to implement, may result in increased engagement and invention disclosures.

Overall, the report highlights a number of important messages that could assist commercialisation professionals in improving the services they provide to researchers in the humanities and social sciences. This remains a nascent area for many TTOs, and flexible thinking will be required to achieve successful outcomes for researchers in these fields. This journey will undoubtedly lead to exciting projects and new commercialisation routes, which could inform the "tried and trusted" methods applied to commercialisation in the STEM subjects.



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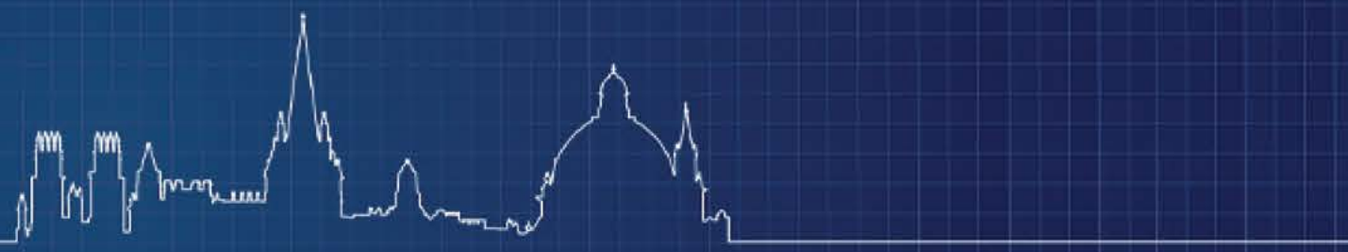

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OXFORD INNOVATION SOCIETY 2017

The Oxford Innovation Society (OIS) is an open innovation network for industry, academia, and investors. This years meetings will be held on:

- Thursday 23 March
- Thursday 15 June
- Thursday 21 September

Meetings are held in Oxford for OIS members and invited guests, and are followed by a formal reception and dinner.

Details on www.innovation.ox.ac.uk/ois

INNOVATION insights

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