INNOVATION insights

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

ISSUE 6 JUNE 2016

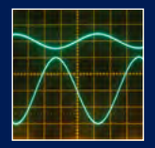
FUNDING TO DRIVE INNOVATION

How Oxford University Innovation is funding innovative ideas ▶

Single cell DNA amplification ▶

Microwave to optical conversion system ▶

Flexible speech recognition system ▶



Real-time monitoring of sinusoidal signals ▶

OXFORD UNIVERSITY INNOVATION

UNIVERSITY OF OXFORD

SUBSCRIBE ▶ | CONTENTS ▶

INNOVATION insights

CONTENTS

Technology and expertise from Oxford

With disclosures from researchers at record levels, this edition of *Innovation Insights* highlights new technologies and the financial mechanisms to commercialise them.

Working closely with partners in the vibrant Oxfordshire cluster, the University of Oxford offers an astonishing breadth and depth of support for entrepreneurial researchers and staff. In this environment innovative ideas can flourish.

When I joined OUI from the space sector a few months ago, I found the breadth of material in *Innovation Insights* to be a fascinating and useful resource. Stories in this edition range from tools for cancer diagnosis and treatment to quantum communications – demonstrating how discoveries and expertise from Oxford contribute to the health and wealth of society. Oxford's international links are in evidence with a separate article on Chinese investor 23Seed, a new member of the Oxford Innovation Society.

The feature article explains how new sources of funding have dramatically accelerated the rate of spinout creation. This is good news for the University, individual researchers and the wider economy. It encourages further efforts to create impact through commercial engagements from staff in all academic divisions.

I hope you enjoy this edition, and welcome your feedback.

Matt Perkins, CEO

News

OUI Annual Report 2015/16 now available
Oxford University Innovation has published its 2015/16 report, which highlights one of the most active years for OUI and the Oxford University innovation ecosystem to date.

FULL ARTICLE ▶

SpyBiotech launches with molecular superglue
SpyBiotech, an Oxford University spinout developing a molecular superglue for rapid development of vaccines targeting a range of diseases, secures £4m seed funding at launch, led by Oxford Sciences Innovation with participation from GV.

FULL ARTICLE ▶

OUI names Adam Stoten as new COO
Dr Adam Stoten, formally OUI's Head of Technology Transfer Life Sciences, has moved into the post of Chief Operating Officer to take over from Linda Naylor, who retired in April.

FULL ARTICLE ▶

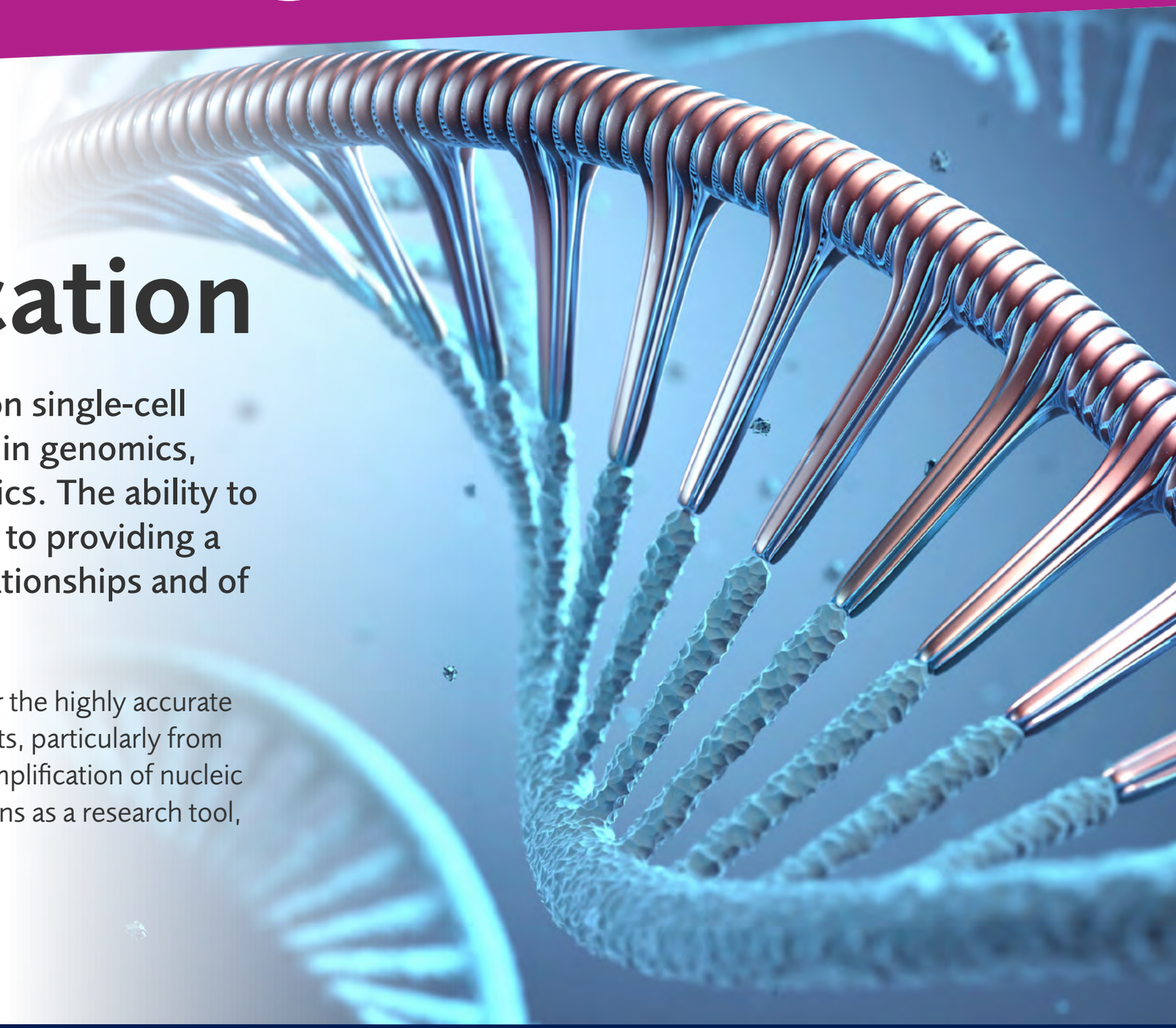
Oxbotica's autonomous vehicles gear up for London to Oxford trial
Oxford spinout Oxbotica is leading a new consortium DRIVEN to test its autonomous vehicle between London and Oxford in the most ambitious driverless car trials worldwide to date.

FULL ARTICLE ▶

Drugs from bugs tops list of LAB282's first round of grants
Oxford University and Evotec's £13m drug discovery partnership LAB282, launched last year to accelerate drugs to market, has begun making awards.

FULL ARTICLE ▶

Single cell DNA amplification



The development of technologies based on single-cell sequencing is rapidly enhancing progress in genomics, epigenetics, transcriptomics and proteomics. The ability to target individual cells will be fundamental to providing a detailed understanding of cell lineage relationships and of the functional states of individual cells.

Oxford researchers have developed a novel method for the highly accurate and reliable amplification of DNA from very low amounts, particularly from single cells. Crucially, the method provides unbiased amplification of nucleic acids. The Oxford method offers widespread applications as a research tool, and for environmental and clinical diagnostics.

FULL WEB PROFILE ▶

Leading research at the BMRU

BMRU is a world-class research imaging facility with over a decade of experience of bespoke high-resolution in vivo imaging, generalised phenotyping, cardiac functional imaging and localised spectroscopy for in vivo metabolic monitoring.

The unit's in-house computed x-ray Tomography (μCT) can achieve high spatial resolution and image contrast in 2D or 3D, both in vivo and ex vivo, and is non-destructive to the samples. The team are currently implementing high resolution in vivo phosphorus spectroscopy for the non-invasive measurement of energy metabolism.

Further developments at the unit are enabling unique opportunities for industrial collaboration tackling preclinical phenotyping, structural and metabolic imaging, and high resolution imaging of non-biological samples.

For further information, please visit the BMRU website ▶

BMRU
British Heart Foundation
Experimental Magnetic Resonance Unit

Generating hydrogen from fossil fuels

Hydrogen is an ideal fuel for the future. It has the highest energy content of any common fuel by weight and produces clean energy and water when used in a fuel cell. Current hydrogen production methods are inefficient and involve carbon emissions that require parallel use of expensive carbon capture technologies.

Oxford researchers have developed a new method of producing H_2 instantly from fossil fuels with minimal oxygenated by-products. The process uses microwave radiation and a cheap, abundant base metal catalyst, generating hydrogen at more than 95% purity. Moreover, using microwave technology significantly simplifies the hydrogen production process. The technology uses the well-established infrastructure of petroleum production and the advantages of the fuel cell, which will enable the hydrogen economy and reduce emissions from the automotive industry.

FULL WEB PROFILE ▶

OUI partners with cardiovascular clinical research

Oxford Cardiovascular Clinical Research Facility (CCRF) is a core facility of Oxford Universities, Division of Cardiovascular Medicine. CCRF has established specialised research services that deliver high quality, world leading, cardiovascular research for investigators throughout the University. This expertise is now being offered to external organisations and industry in partnership with OUI Consulting Services Group. Services include:

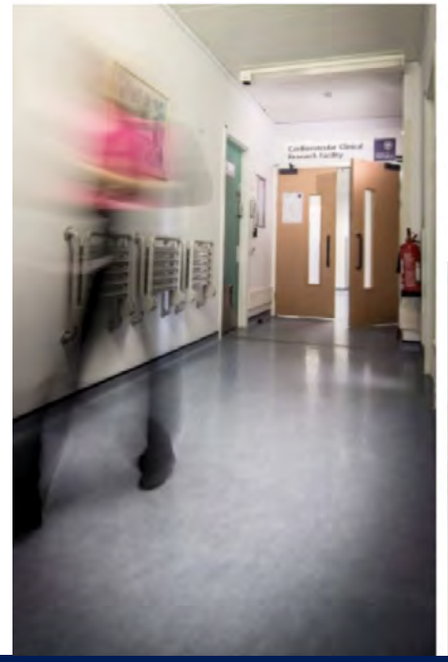
Echocardiography Core Laboratory: A core analysis laboratory, providing state-of-the-art echocardiographic imaging interpretation and analysis from single investigator pre-clinical studies through to global multi-site clinical trials.

Exercise and Vascular Physiology: Using exercise as an intervention or for clinical assessment, a laboratory encompassing treadmill, exercise bike, tilt table testing, ECG, blood pressure monitoring and more.

Clinical Trial planning: expertise on protocol design, data collection and analysis, patient recruitment, and more.

CCRF Cardiovascular Clinical Research Facility

FURTHER INFORMATION ▶



Microwave to optical conversion system

Quantum technologies are quickly influencing the technological landscape. Products harnessing quantum effects for sensing and communication have already reached the marketplace.

Oxford researchers have developed a device that enables coherent interconversion between microwave and optical photons. This invention has numerous applications across the spectrum of quantum technology, including powerful signal processing, detection of hidden metal objects, subcutaneous cancer detection, and in communication channels enabling a scalable network of superconducting quantum bits for computing.

FULL WEB PROFILE ▶

23Seed, a Chinese Oxford Innovation Society member

During the last five years, 23Seed, a Chinese innovation incubator, has provided startups from around the world with venture capital financing, mentorship, and policy support. Located in one of the most recognised technology parks in Shanghai, 23seed manages multiple investment funds to invest in early stage technology startups. Today, its direct equity investment portfolio contains more than 50 domestic and overseas companies.

In 2015, Daniel Shi, the company founder, produced China's first international venture capital reality show "The Next Unicorn". The TV show offers entrepreneurs the chance to pitch their business endeavour to a panel of corporate partners in return for investment. So far, investors have invested £10 million in new technology ventures and built networks in over seven continents and 11 countries.

23Seed

FULL WEB ARTICLE

Homogenous droplet generator for microfluidic samples

The ability to generate fluid droplets is of vital importance for applications across chemical synthesis, drug screening and biomedical testing. Currently available methods for achieving this require complex and expensive sealed multi-channel fluid channel networks. The current methods also suffer from the creation of dead volume within the complex networks, from which significant portions of the fluid sample cannot be recovered.

Oxford researchers have developed a method by which homogenous droplets can be generated, stored and applied using a single channel. This substantially reduces complexity and cost of the process and will be particularly advantageous for applications in digital PCR, single cell analysis, and rare molecule detection.

FULL WEB PROFILE ▶

The Oxford Startup Careers Fair

Oxford University Careers Service together with Oxford AI Society and Oxford Entrepreneurs hosted the annual Entrepreneurs Careers Fair at Saïd Business School.

Held in the Oxford Launchpad, a co-working space within the Business School, startup companies and students, graduates and researchers met with companies to talk informally about growing their own businesses and explore potential employment opportunities. Animal Dynamics, Mind Foundry, Oxbotica, Oxehealth and Zegami were among a few of the exhibiting companies highlighting a wide range of technologies.

The day concluded with a panel discussion on 'how to fund a spinout/startup company'. James Mallinson, OUI Spinout Equity Management, moderated the discussion with panel members Samuel Conway – Zegami, Huw Jones – Chronos Therapeutics, ZeShaan Shamsi – Onfido, Andrew McLean – Oxford Science Innovation, and Ben Hall - Oxford Flow.

FURTHER INFORMATION ▶

Highly efficient genetic variance detection software

As the use of high throughput sequencing (HTS) data in clinical diagnosis becomes more widespread, new tools are required to ensure that we make the most of these incredibly rich and complex data sets. Current solutions have proven to be either too focussed or too simple which results in limited amounts of accurate output data.

Researchers at the University of Oxford have developed Octopus, a data analysis tool based on a powerful Bayesian framework, which achieves class-leading performance. The generalised nature of the technology means that it can easily extend to a variety of niche samples.

FULL WEB PROFILE ▶

MEPC breaks ground on new £24m development

Construction work at OIS member MEPC's Park Drive East development at Milton Park has commenced. This is the first part of the 12-month development plan for one of the regions' largest office and laboratory developments.

Park Drive East will consist of three separate buildings (141, 142 and 143 Park Drive), and include a Grade-A office building as well as two hi-tech laboratory facilities. The Grade A office building is expected to complete by the end of the year, which will quickly accommodate the ongoing demand for high-quality office and laboratory space in Oxfordshire. The two remaining buildings are expected to complete in spring 2018.

The development is situated on a 7.6-acre site located towards the eastern end of the leading science and business park. It falls within the Science Value UK Enterprise Zone.

FULL WEB ARTICLE ▶

Label-free detection and mass spectrometry in solution

Interferometric Scattering Microscopy (iSCAT) is by far the most sensitive label-free single molecule biosensing technique currently available to the research community. The technique offers single molecule sensitivity without the use of any labels or reporter molecules with increasing application of biomolecular interaction analysis in drug discovery.

However, widespread adoption of this technique in the pharma/biotech industries and research facilities has been limited owing to the expensive and complex experimental setups involved. Oxford researchers have developed a simple, inexpensive, and accessible implementation of iSCAT, which addresses the disadvantages restraining the fast growth of label-free single molecule detection and mass spectrometry. The miniaturisation of the microscope offers improved performance and opens up the use of iSCAT to a substantial global market and user-base.

FULL WEB PROFILE ▶

Isis Enterprise rebrands as Oxentia

Isis Enterprise, the global innovation management consultancy of Oxford University Innovation, has rebranded as Oxentia and will establish itself as a separate entity later this year.

The name Oxentia was developed from two core concepts; 'Ox' is a reflection of Oxentia's location and experience within the city of Oxford and 'entia' echoes the 12-year history operating as Isis Enterprise. Oxentia's logo expresses the global nature of its business and is reminiscent of the Radcliffe Camera, an iconic feature of the Oxford skyline. While the nature of the business and services remains unchanged, the creation of Oxentia provides an excellent platform for growth over the coming years. Oxford University Innovation will retain an ownership position in the new company, and the two organisations will continue to collaborate on relevant projects.

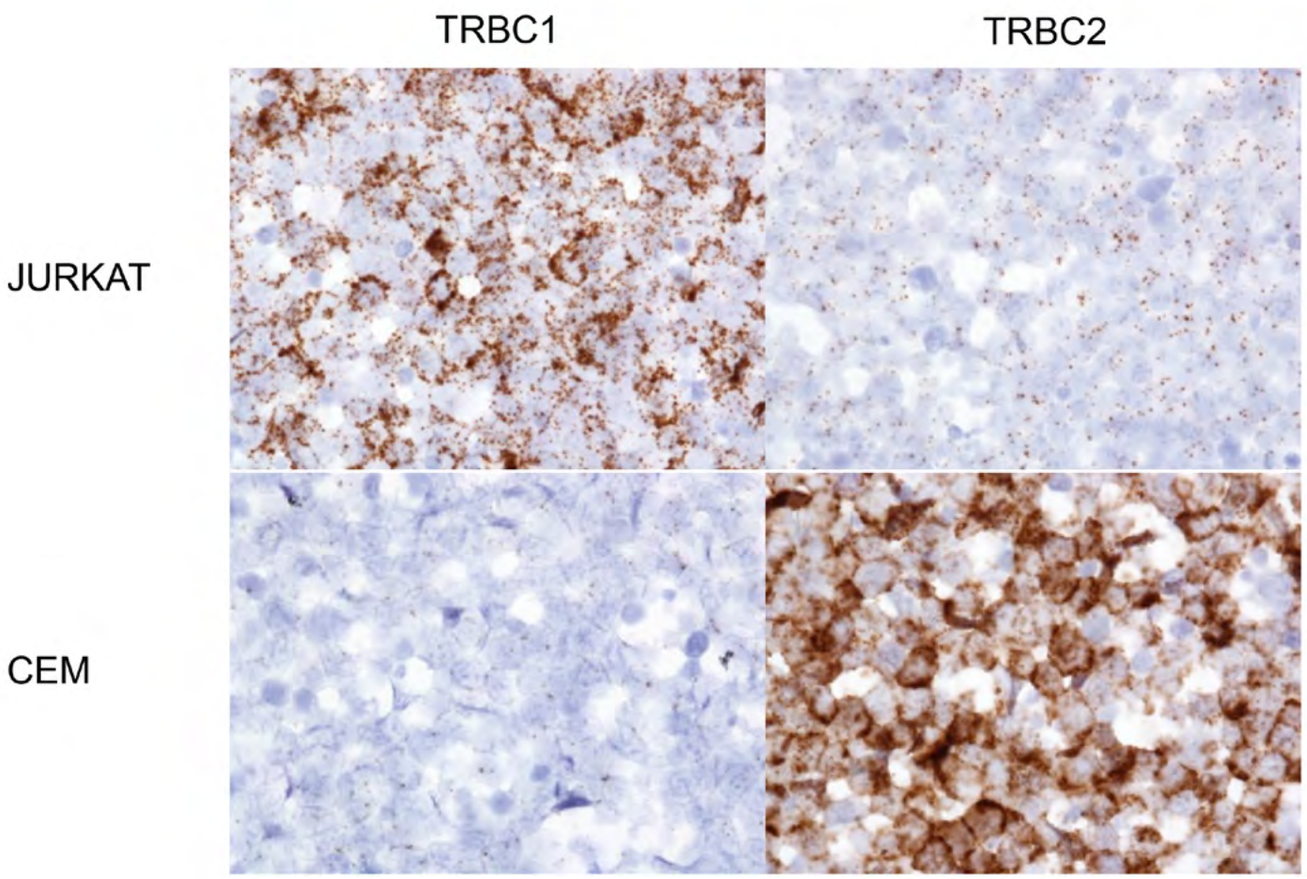
FURTHER INFORMATION ▶

OXENTIA

Comparison of benign and malignant cases

Researchers at Oxford have developed a technology that offers a cheaper, quicker, simpler diagnostic test to distinguish benign and malignant T cell populations.

They have identified that alpha-beta T cells express either beta constant region 1 or beta constant region 2 in roughly equal proportions. By probing T cell infiltrates for their expression of constant beta 1 vs constant beta 2, an idea can be gained whether the infiltrate is malignant or not.



FULL WEB PROFILE ▶

Flexible Speech Recognition System

Most automatic speech recognition (ASR) systems, which are generally based on statistical-modelling techniques, require extensive training from thousands of recorded speakers just to master the variation within one dialect. High degrees of accuracy are only achieved with multi-layered and computationally intensive models, requiring either state-of-the-art hardware, or, in the case of mobile applications, a network connection to offload the analysis. In addition, many systems also need to be trained against a particular voice to attain accurate recognition.

Oxford's FlexSR system outperforms many existing ASR systems at individual word recognition, and its lightweight nature is ideally suited to integration into existing technologies or for mobile deployment.

FULL WEB PROFILE ▶

Supporting the academic community

The Oxford Innovation Society brings together leading academics from the University to meet and engage with business and industry to identify and discuss themes, challenges and opportunities emerging from their work.

The March OIS meeting, in Pembroke College, was sponsored by the STFC (Science & Technology Facilities Council) with talks covering work at Harwell's Science and Innovation campus.

Elspeth Garmen, Professor of Molecular Biophysics, University of Oxford discussed the latest advances and technology breakthroughs in structural biology. Bill David, Professor of Materials Chemistry, University of Oxford and STFC Senior Fellow spoke on the energy generation, conversion, storage and usage in Harwell and worldwide.

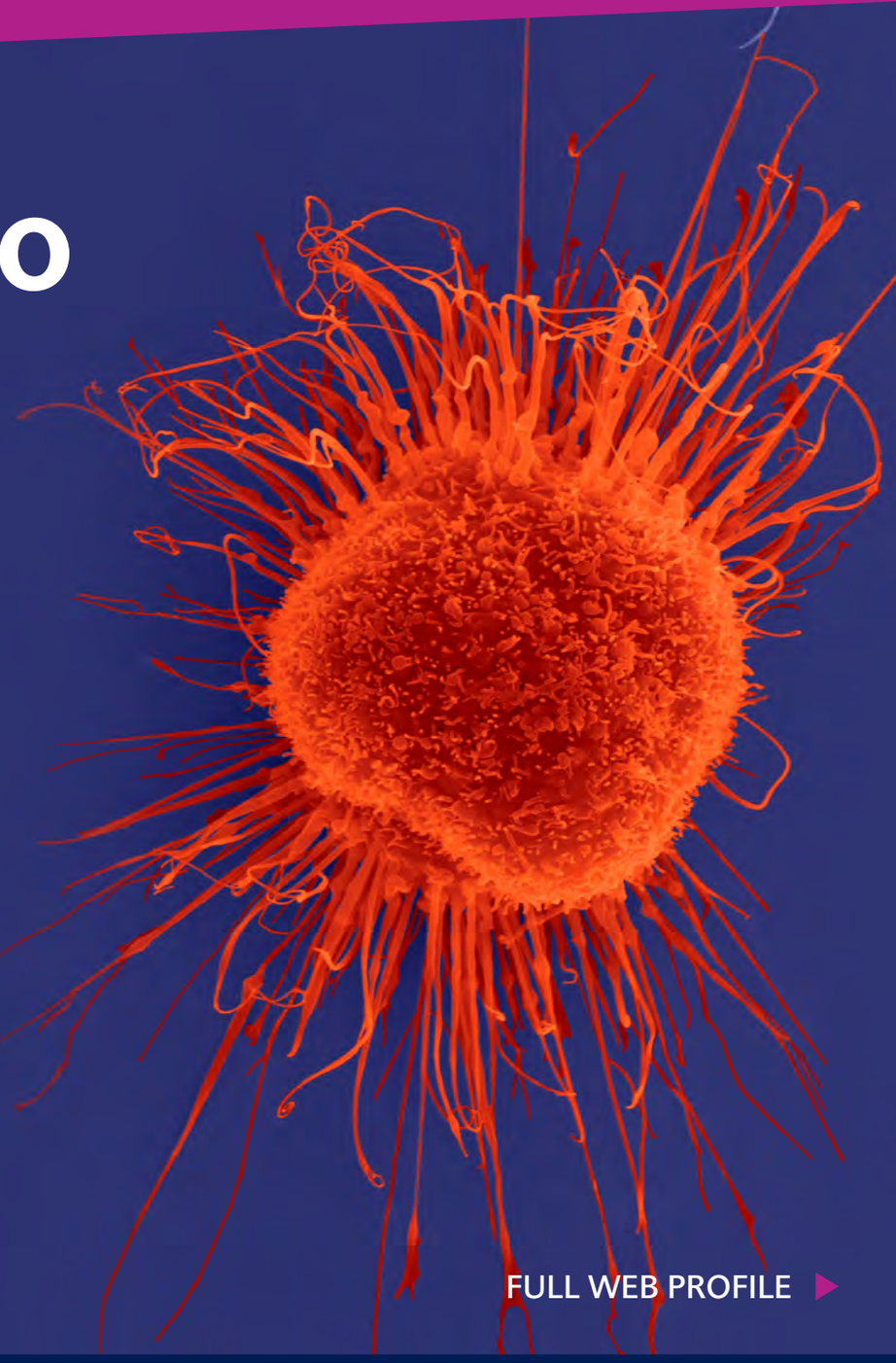
Dr Deborah Buckley-Golder, Head of Research Portfolio, Innovate UK also shared her views on the exciting and rapidly changing landscape of science, innovation, and commercialisation of academic research both within the university and the wider UK.

FURTHER INFORMATION ▶

A promising approach to cancer immunotherapy

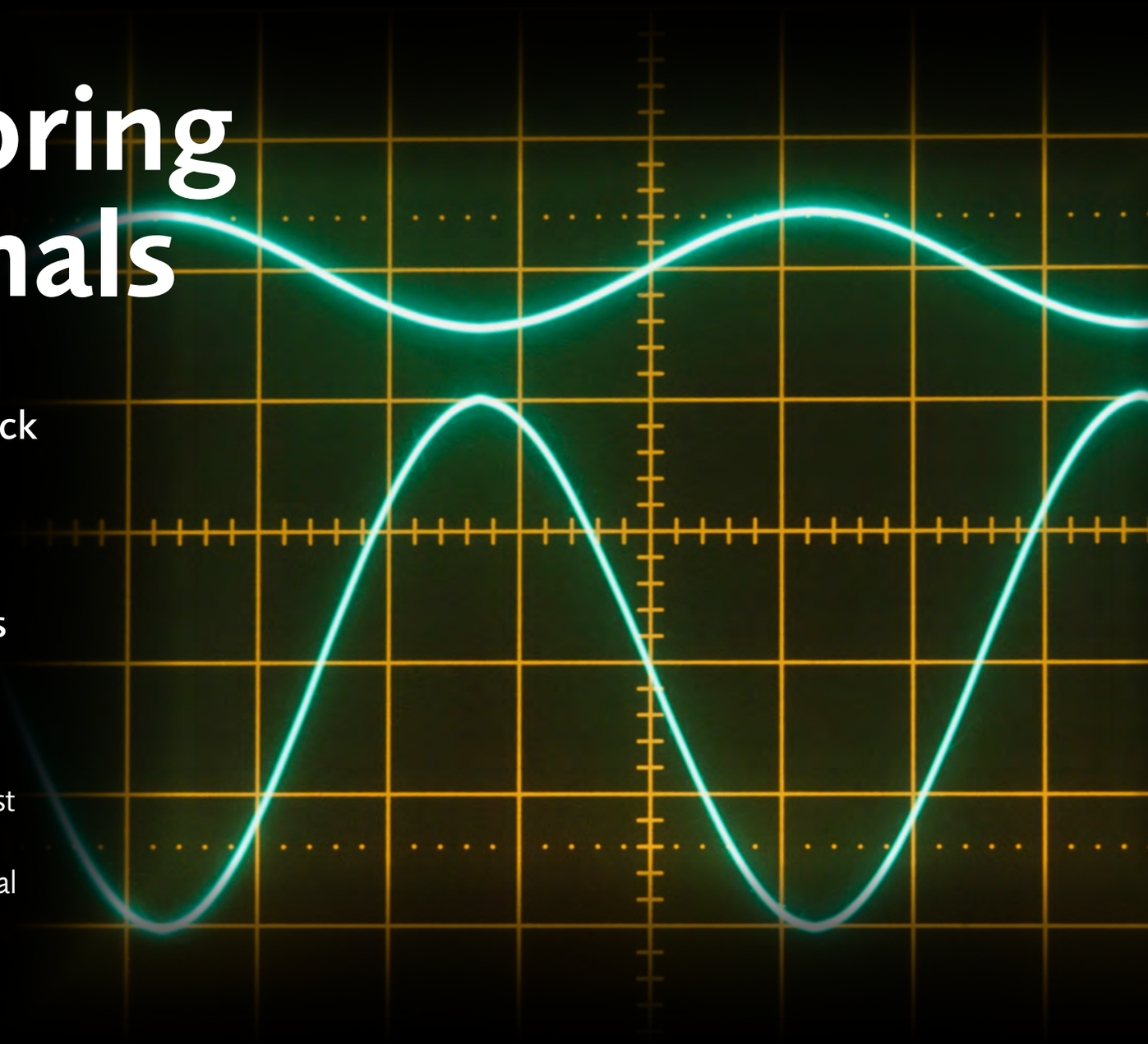
Immune cells called Dendritic cells (DCs) could be used as potent cancer vaccines. These cells exist in very small quantities in people, so a two-step process is used to create more. First, a sample of patient cells is taken (e.g. a skin or blood sample). These cells are turned into a special type of cell called stem cells, and multiplied. Secondly, these stem cells are turned into useful Dendritic cells. These are then activated, using parts of the patient's tumour, and injected back into the patient to activate the immune system to fight the tumour.

Dendritic cells generated this way have the properties of immature foetal cells – instead of activating the immune system, they turn it down (as they do normally to prevent a foetus being attacked by the mother's immune system). To circumvent this, Oxford scientists have found a way to create cells with 'adult' properties, which are very effective at stimulating the immune system. The hope is that this method may help in the fight against cancer.



FULL WEB PROFILE ▶

Real-time monitoring of sinusoidal signals



Sinusoidal signals are encountered in many technology areas and methods. Finding a way to track these outputs is crucial. Current signal monitoring methods are highly specific, but the development of more flexible, generalised techniques would be beneficial in order to facilitate the Internet of Things (IoT) and other sensor networks.

Oxford researchers have developed the Prism object; a flexible and efficient signal monitoring methodology, which operates at the lowest theoretical bounds of variance. This new approach has widespread application across any field where it is necessary to monitor sinusoidal signals rapidly and in real-time.

FULL WEB PROFILE ▶

IMPUTE 4

Genome-wide association (GWA) studies offer unprecedented insight into the genetic variants that underline common human diseases. Work over the last decade in the field of human genotyping has allowed GWA to become a viable clinical tool. Current GWA studies examine a huge number of markers using commercially available SNP (single nucleotide polymorphism) chips.

As there are more than 85 million SNPs within the human genome, the SNPs assayed on the chip are unlikely to include the causal variant. Oxford researchers have developed IMPUTE, a method for identifying causal variants that have not been directly genotyped by utilising an imputation approach.

FULL WEB PROFILE ▶

Funding to drive innovation

How Oxford University Innovation is finding the cash to fuel innovative ideas

The recipe for spinout success varies from university to university, but all have the same key ingredients. You need solid, forward-thinking ideas to form a company around. The team behind the spinout have to be experienced, passionate, and know how to develop their technology. The university and the ecosystem around it has to be supportive of innovation, and provide access to resources and mentorship that can help that company thrive. And, crucially, there has to be money to help that spinout get off the ground.

In a small number of cases, spinouts can quickly get to market and start selling their products within a couple of years of formation. However, most spinout companies require a long period of development. Some can take up to ten years before they are ready to start making a profit; a few can take even longer.

CONTINUED ▶

INNOVATION insights

FEATURED ARTICLE

What's more, working on the cutting edge of science has its downfalls. The underlying technology for many spinout companies is often breaking new ground – some are even creating new industry sectors. While exciting and incredibly important for driving forward human progress, finding financial support for an unproven technology at an early-stage of its development can present a challenge.

The prospect of placing bets on companies which require early-stage funding and long-term support can rattle even the most unflustered of investors. To counteract this and to find cash to make university innovation possible, institutions across the UK have developed their own funds to help support spinouts. Oxford in particular has developed a number of vehicles to support spinouts.

The largest of these has been Oxford Sciences Innovation (OSI). Since launching in 2015, the company has raised £580m to invest in Oxford spinouts. The impact OSI has had on the University's innovative output in under two years has been staggering. OUI saw its spinout generation rate jump from 10 in 2015 to 21 in 2016, while the amount of early-stage seed funding invested went from £9.5m in 2015 to £52.6m, with OSI acting as a beacon for other investors.

CONTINUED ▶

INNOVATION insights

FEATURED ARTICLE

OSI's fund has been made possible thanks to the spinout equity share between the university and founding academics, with the University gaining a stake in OSI in return for half of its equity share in new companies arising from its two scientific divisions. This means that OSI can offer up to a quarter of the equity in the majority of spinouts emerging from the world's number one ranked University to its investors – an offer which has led to OSI becoming the largest fund of its type in the world. The capital it has been able to raise as a result means that OSI is better placed to provide support for spinouts from when they launch through to becoming financially sustainable businesses of real critical mass – and significant value. The University, meanwhile, will benefit as the valuation of OSI's portfolio increases.

OUI is also supported by Parkwalk Advisors with an annual fund, the University of Oxford Innovation Fund. Now entering its fourth iteration, this seed-stage focused fund provides critical funding for new companies. It takes advantage of the Seed Enterprise Investment Scheme (SEIS), introduced by the Government in 2012, which offers generous tax breaks to investors in return for providing cash that can be used for early-stage investment. To date, UOIF has committed £4.5m to 18 companies emerging from the University.

CONTINUED ▶

INNOVATION insights

FEATURED ARTICLE

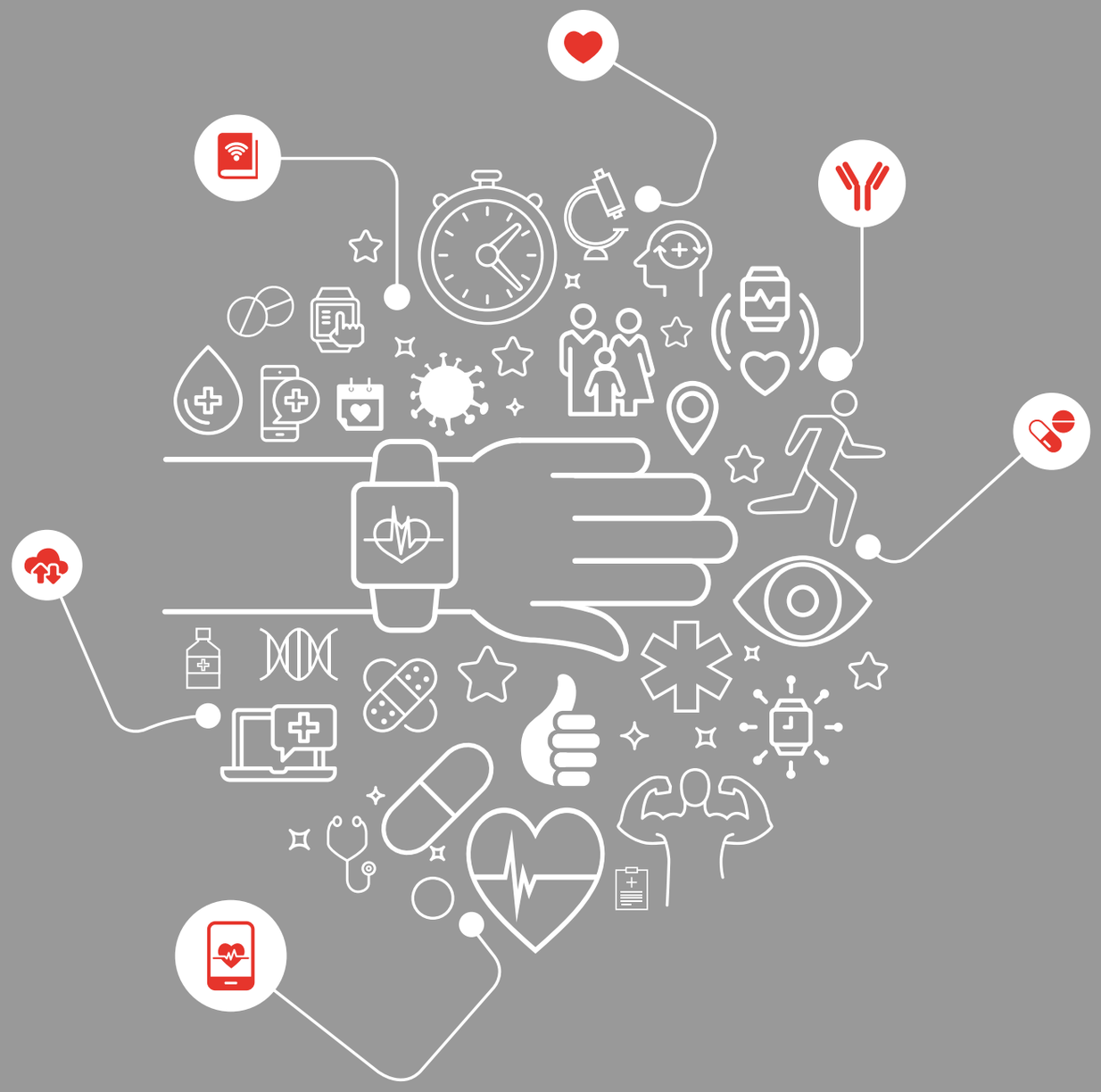
LAB282

Recently, OUI also helped establish LAB282, a new kind of partnership designed to accelerate drug discovery from basic research. The University, OSI and Evotec, working together as LAB282, target promising ideas that could form the basis of a spinout company and provide both expertise and finance to bring them closer to market. With £13m to deploy over a three year deal, LAB282 aims to accelerate over 40 projects during this time. Started late last year, LAB282 has already made its first investments, and is currently preparing for its June round.

These funds, as well as others like them in our external investor network, have become essential to getting great ideas out of the door and helping them grow. As our ecosystem goes through an innovation boom, we expect to see more collaboration with finance to help us further evolve our innovative output.

FURTHER INFORMATION ▶

Precision Medicine and Digital Health Technology Showcase Oxford 2017



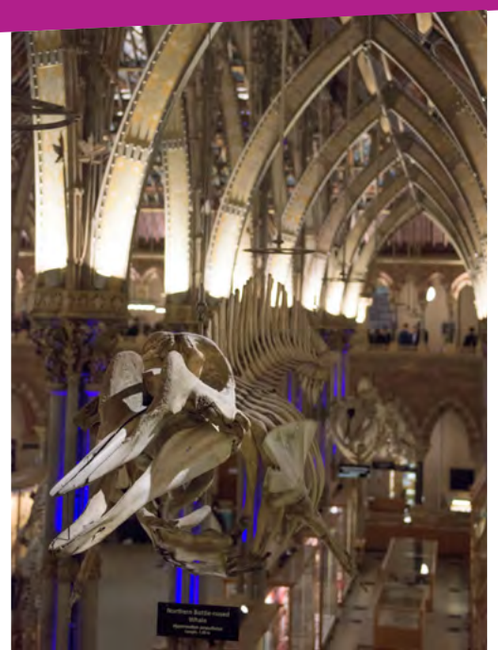
Tuesday 27th June 2017, 12.00pm - 18.30pm
Saïd Business School, Park End Street, Oxford OX1 1HP

Technology Showcase Oxford will focus on new technologies and research initiatives from around Oxford and the region, and celebrate recent technology and research initiatives in precision medicine and digital health technology.

Click here for the programme ▶

Click here to register ▶

INNOVATION insights



OXFORD INNOVATION SOCIETY 2017

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

- Tuesday 20 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

Oxford University Innovation Ltd
Buxton Court
3 West Way
Oxford
OX2 0JB

T +44 (0)1865 280830
E enquiries@innovation.ox.ac.uk
W innovation.ox.ac.uk

Designed and produced by www.imageworks.co.uk