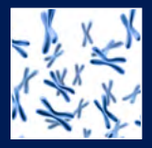
INNOVATION insights

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

ISSUE 7 SEPTEMBER 2017

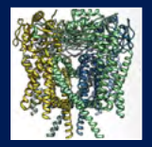
VIRTUAL REALITY IN OXFORD

How Oxford University academics are using VR to save lives ▶



Identifying shared ancestry ▶

Thermochromic materials for smart buildings ▶



Understanding disease pathways with Cryo-EM ▶

Superconducting Qubit Coupler ▶

OXFORD UNIVERSITY INNOVATION

UNIVERSITY OF OXFORD

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INNOVATION insights

CONTENTS

Universities are good for us

... and commercialising their work ensures that everyone benefits

The value of Universities to their local communities, wider society and the economy is clear, so it is self-evident that governments and industry should encourage their activity.

A new report for Oxford University, undertaken by Biggar Economics, shows that the global impact of the University's activities is £7.1Bn. Of this, £5.8Bn is realised as contribution to the UK economy, with more than 50,000 full time jobs created and sustained as a consequence.

The report confirmed that Oxford is the most prolific higher education institution in the UK in terms of licensing technology, accounting for £1 in every £10 of licensing income received by UK universities. The vast majority of our 136 spinout companies are still based in the UK. In Oxfordshire alone they contribute £132m to the local economy, employing 1,886 people.

Their growth continues to attract investment – with an additional £93m raised during Q2 of this year. With a further four spinout companies launched during the quarter the impact of commercialisation activities will continue to grow.

We hope that you enjoy reading news of the latest innovations from Oxford in this edition of Innovation Insights.

Matt Perkins, CEO

News

Nightstar plans to go public on the NASDAQ
Nightstar Therapeutics, Oxford University spinout developing gene therapy treatments for rare inherited retinal diseases, has announced plans to hold its initial public offering (IPO).

FULL ARTICLE ▶

OUI names new Heads of Tech Transfer
Dr Paul Ashley and Dr Brendan Ludden have been named as the Heads of Technology Transfer at Oxford University Innovation.

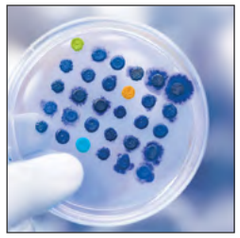
FULL ARTICLE ▶

Oxentia forms as independent company
Oxentia, the global innovation consultancy arm of Oxford University, has become a separate legal entity, marking the first Oxford University spinout of the financial year.

FULL ARTICLE ▶

Oxford University AI Company secures investment
Oxford spinout, DiffBlue, an Oxford University spinout company developing an artificial intelligence (AI) capable of writing code, has received £17m in Series A funding.

FULL ARTICLE ▶



£13m drug discovery partnership with Evotec and Oxford Science Innovation
LAB282, the drug discovery partnership for Oxford University, has made its second round of awards to support new life sciences projects.

FULL ARTICLE ▶

Vaccines for Staphylococcal Disease

The Staphylococcus group of bacteria represents some of the most important bacterial pathogens to humans. Infections caused by this group result in skin, wound, and deep infections which are potentially life-threatening. Resistant strains, such as MRSA, are routinely spread in hospital environments, and there have been instances of continent-wide epidemics.

Available treatments range from antibiotic creams for minor infections, to surgery and prolonged courses of antibiotics for more serious conditions. There is currently no effective, commercially available vaccine for staphylococcal infections.

Oxford researchers are developing a viral vectored, multi-valent vaccine incorporating newly characterised antigens to protect against staphylococcal bacteria. Pre-clinical data indicates that there is the potential of developing a single-dose vaccine to induce effective and robust immunity against staphylococcal bacteria. Such a vaccine would have global applicability in the fight against a common set of infections, which are also prevalent in livestock.

FULL WEB PROFILE ▶

Cycle.land sows seeds for bike sharing success

Cycle.land, the Oxford University startup developing the AirBnB of bike sharing, has successfully completed its £370,000 seed round.

The deal marks a first for OUI's incubator companies as it combined both crowdfunding sourced through the Seedrs platform with regular investment from Parkwalk Advisors.

The company has expanded rapidly since its launch last year and is now operating in Cambridge and Edinburgh as well as Oxford. It plans to extend its reach further following the latest investment, with plans to begin operating in Bristol, Brighton and London in the coming months.

Cycle.land has also recently been working with the University, City and County councils to manage the influx of bike sharing companies already operating or planning to launch in Oxford. The company led an initiative to create a Code of Conduct for bike sharers to adhere to, which the team hope will help integrate bike sharing into the city seamlessly.

FURTHER INFORMATION ▶

Identifying shared ancestry

The ability to identify the origin of an individual through quantifying the degree to which its DNA is shared with other populations is a powerful tool. If done accurately, it can provide insight into evolution, migration and ancestral mixing events. This would not only apply to humans, but to many other species throughout the animal kingdom.

Researchers at the University of Oxford have developed an algorithm which can precisely identify stretches of DNA reflecting shared ancestry and compare these to a reference panel. This algorithm currently represents the most accurate and powerful tool for carrying out these ancestral analyses.

FULL WEB PROFILE ▶

Driving standards

Dr Kathy Parkes engaged Consulting Services when she was approached by the Driver and Vehicle Standards Agency (DVSA). The DVSA was looking to tap into her knowledge and expertise around workload among Driving Examiners and wanted to understand the potential effects of increasing the number of driving tests each Examiner conducts from 35 to 37 per week.

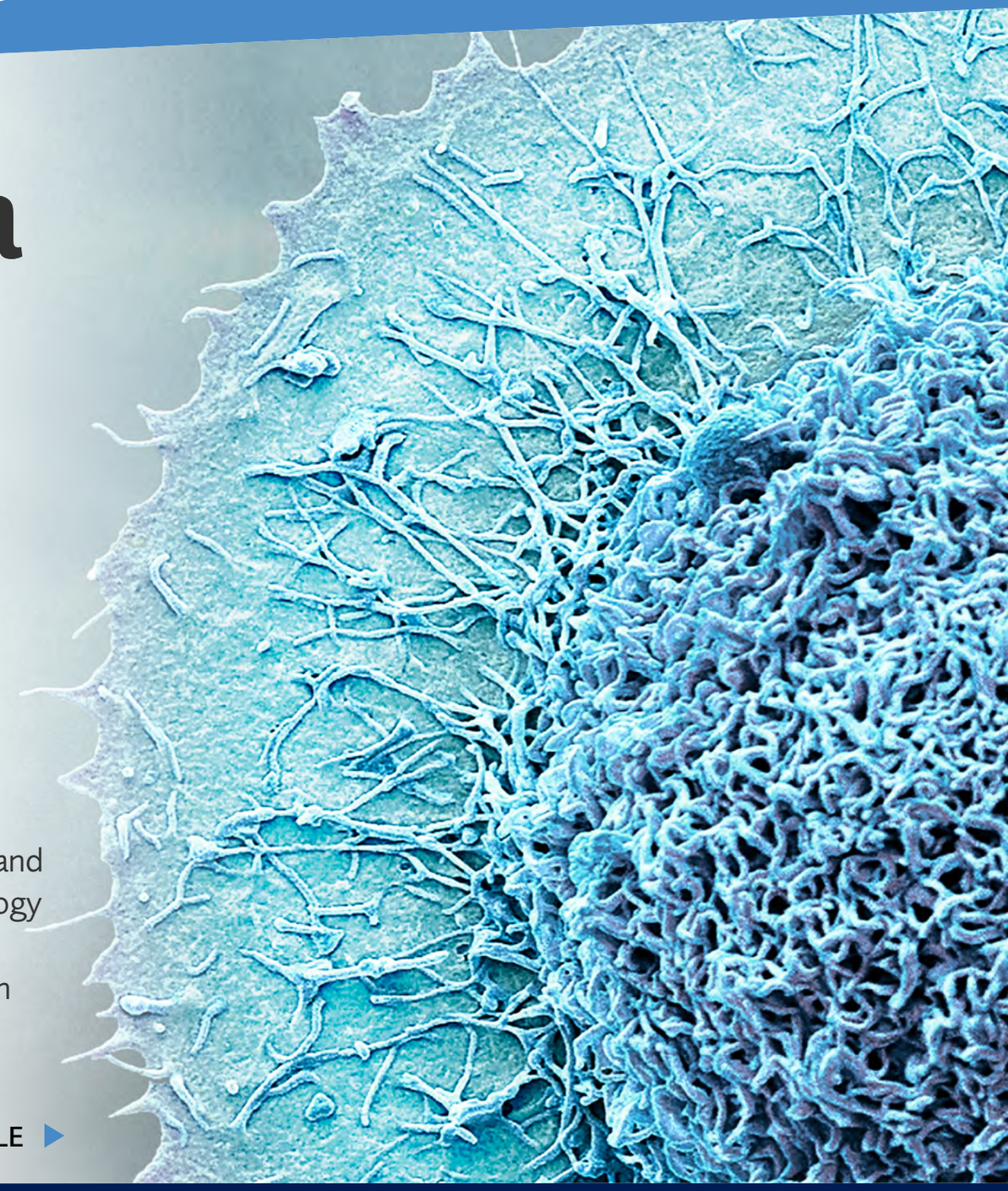
While the increment may seem slight, it potentially adds extra time pressures to the already stressful job of assessing inexperienced drivers taking a practical driving test. The findings of Kathy's comparison of data from the 1980s and the DVSA's current data contributed to a wider review of the content and scheduling of driving tests. Consulting Services assisted Kathy with her initial engagements with the DVSA, negotiated the contract and helped chase down data from the DVSA essential for her consultancy work.

FURTHER INFORMATION ▶

Identifying dysplasia and cancer

Oxford researchers have developed an endoscopic tool and molecular marker spray that can be used to stratify tissue during endoscopic procedures. The tool enables surgeons to easily visualise tissue that is dysplastic or cancerous, including flat lesions and polyps that would have previously been missed by traditional white light methods.

The technology relies on a fluorescent lectin that has different affinities for normal, dysplastic and cancerous tissues. This enables simple identification of tissue types, and reduces the incidence of false negatives and missed dysplastic tissue. This technology can be used for distinguishing between polyps, or different grades of dysplasia, identifying flat lesions in patients with ulcerative colitis, and can help guide resection margins during endoscopic polypectomy. As a result, patient outcomes would be greatly improved and overall NHS costs reduced.



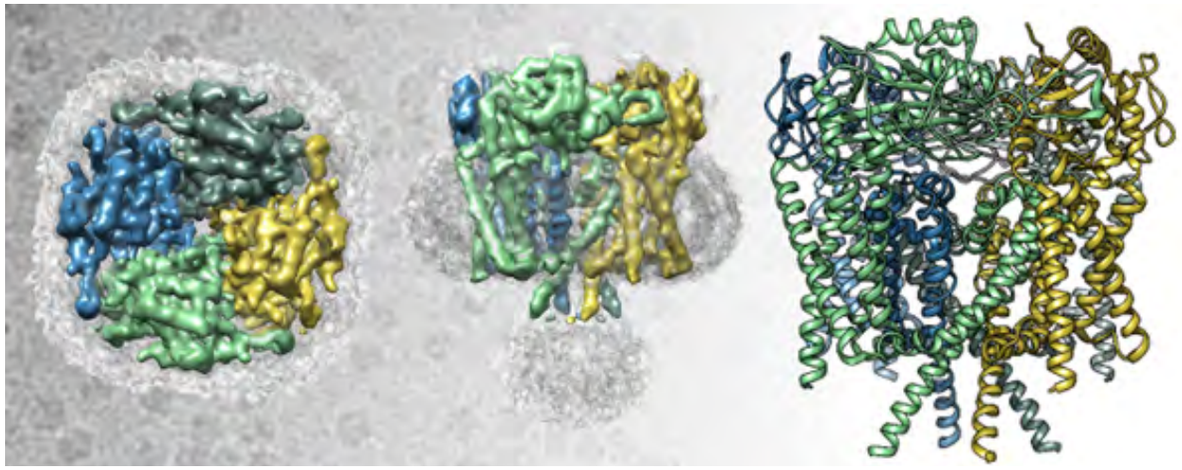
FULL WEB PROFILE ▶

Understanding disease pathways with Cryo-EM

Cryo-electron microscopy (Cryo-EM), where samples are flash frozen before images are recorded, offers the ability to study proteins, viruses and other biological samples at near-atomic resolution without the need of crystallisation. Results have contributed to our understanding and ability to target disease pathways. This is recognised by recent investments of £20m from Wellcome Trust and £11.3m from the Medical Research Council, the latter of which will support a containment facility in Oxford to enable studies of dangerous pathogens.

Cryo-EM equipment is costly and requires specialist expertise to operate. Oxford Particle Imaging Centre (OPIC) benefits from having several high-resolution instruments. OUI Consulting Services have set up service contracts with pharmaceutical companies for use of the facility.

OUI also arranges for Professor Juha Huiskonen to provide advice on sample preparation, data collection and computational analysis, allowing clients to benefit from Oxford's facilities alongside its expertise.



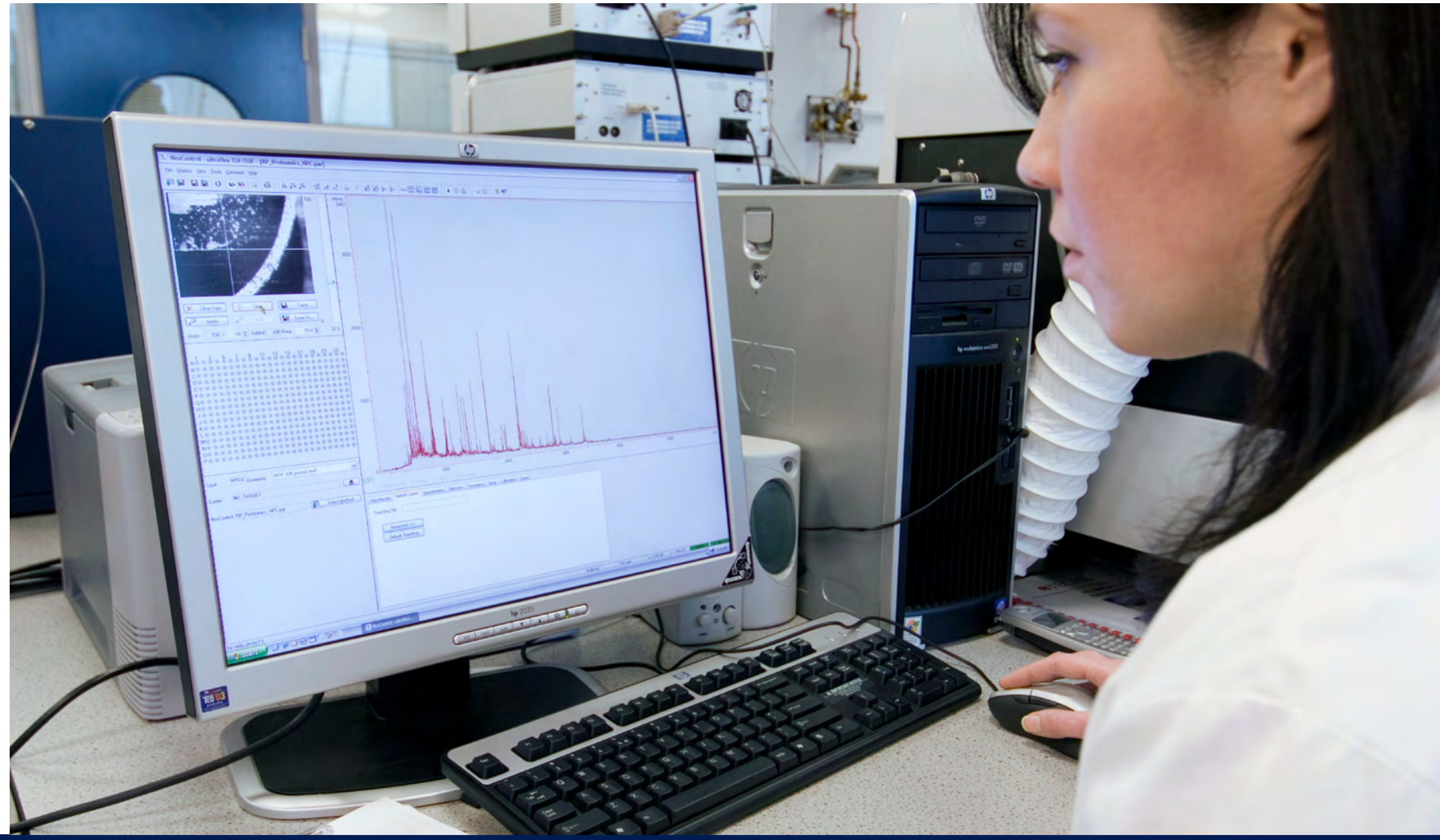
FURTHER INFORMATION ▶

The fluorescent solution

Researchers at Oxford have developed a novel software tool with optimised work-flow for correlating, processing and fitting scanning fluorescence correlation spectroscopy data.

It will be used by scientists to process and analyse their scanning correlation data from commercial turn-key microscopes and custom microscopes. At the moment, there is no software solution that can do this at bulk levels with as much ease.

FULL WEB PROFILE ▶



Puhua Capital, a leading private equity firm from China

Puhua Capital
普华资本

During the past 14 years, Puhua Capital has become one of the most successful private equity firms in China. With offices located in Beijing and Shanghai, the company manages 75 private equity funds with a total amount of 11.5 billion RMB capital assets. They have invested in 300 healthcare companies and successfully exited from 40 by initial public offering and mergers and acquisitions.

Having recently joined the Oxford Innovation Society, Puhua Capital is looking to make significant investment in the UK healthcare technology sector, establishing links with potential partners who wish to co-invest in existing Chinese companies.

FURTHER INFORMATION ▶

A robust algorithm for patient monitoring

Medical professionals and healthcare providers routinely use the four traditional vital signs; body temperature, heart rate, respiratory rate, and blood pressure to detect or monitor a patient's medical problem.

Measuring a patient's respiratory rate can often be inaccurate and due to existing methods only testing whether or not the incoming data is artefactual. Performing respiratory rate estimation in this manner is not robust, especially in environments where the patients are elderly or sick – as is usually the case in clinical practice.

Researchers at the University of Oxford have developed a method to determine whether or not data from sensors (either patient-worn or via video) contain physiological information of a patients respiratory rate.

FULL WEB PROFILE ▶

Collaborating to innovate - Oxford and Japan

Merton College, Oxford was the chosen venue for the June Oxford Innovation Society meeting and dinner. Dr Matt Perkins, CEO of Oxford University Innovation provided the opening remarks followed by an insightful introduction from the Ambassador of Japan to the United Kingdom, H.E. Mr Koji Tsuruoka.

Professor of Engineering Science and Physics Donal D.C Bradley, Oxford University, delivered the first part of the evening lectures on the physical developments in organic semiconductors and OLED displays. Hirokuni Miyamatsu, the CEO of KAHM Japan, followed with the possibilities of AI and Blockchain technology providing a robust data infrastructure to healthcare providers.

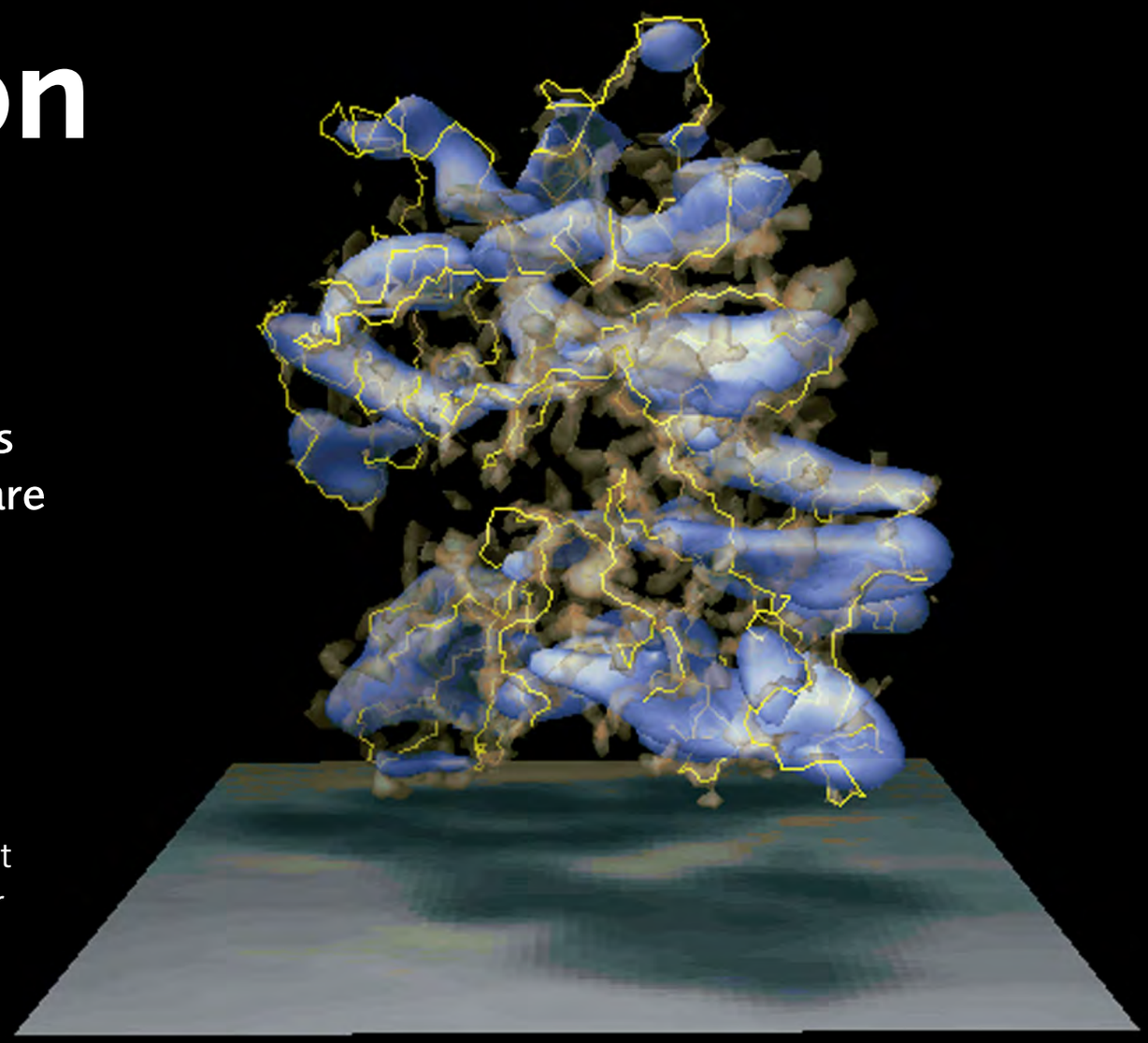
Fujitsu Laboratories of Europe CEO Dr Tsuneo Nakata, shared his views on the company's unique approach to investing in AI technology.

FURTHER INFORMATION ▶

Solving the electron density map

Collision cross sections (CCSs) are key protein structural parameters, which provide information about a molecule's conformation or assembly arrangement. Currently CCSs are estimated using ion mobility (IM) experiments, which are inaccurate for more flexible proteins and large molecular assemblies.

Oxford researchers have developed EM∩IM, a piece of software capable of accurately calculating CCSs from Electron Microscopy (EM) density maps correlated with IM data. Up until now calculating CCSs from EM data has not been possible, so EM∩IM could allow rapid, facile determination of CCSs for large protein assemblies.



FULL WEB PROFILE ▶

Thermochromic materials for smart buildings

Oxford researchers have developed solution-based, scalable processes for the production of powders and thin-films of thermochromic metal oxides.

Such materials have numerous applications in energy management of commercial and residential buildings, protection of exposed electronics against heat damage, infra-red camouflage for military assets, and encapsulation of flexible OLED devices.

The manufacturing processes make use of simple and readily available precursors, enabling low-cost adoption of the technology on a large scale.

FULL WEB PROFILE ▶

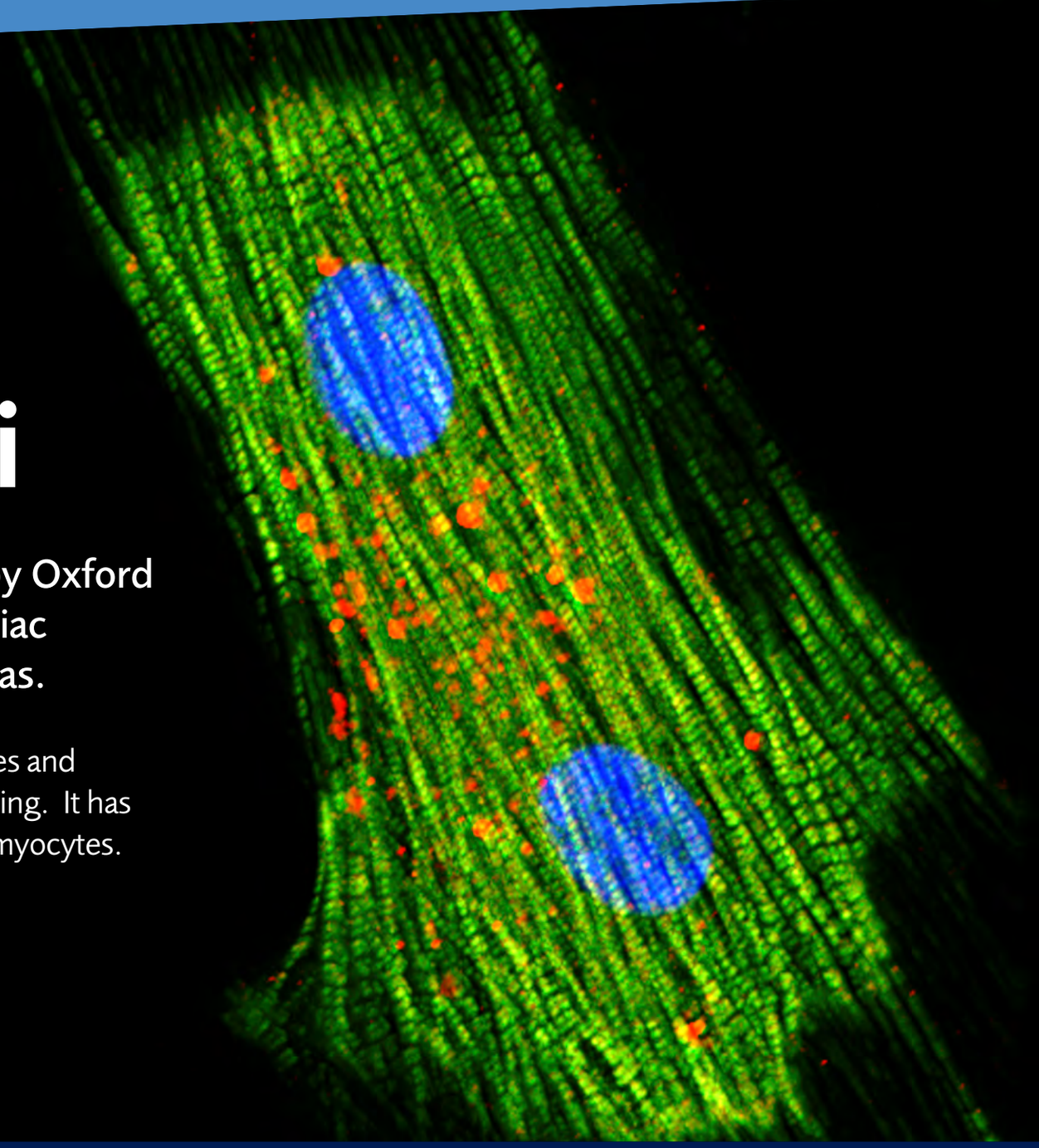
Metal-organic frameworks for photonic applications

Metal-organic frameworks (MOFs) are one-, two- or three-dimensional matrices of metal ions and organic ligands. Synthesis of MOFs has traditionally been a lengthy and energy-intensive process. Furthermore, attempts to capture small molecules or nanoparticles inside the MOF structure have generally been unsuccessful.

Researchers at the University of Oxford have developed a synthetic protocol, which can access optochemically responsive MOFs containing a range of light-emitting guest species. This rapid, simple and high-yielding process has been used to synthesise functional MOFs, capable of detecting volatile organic compounds (VOCs) via tuneable photonics-based sensing.

FULL WEB PROFILE ▶

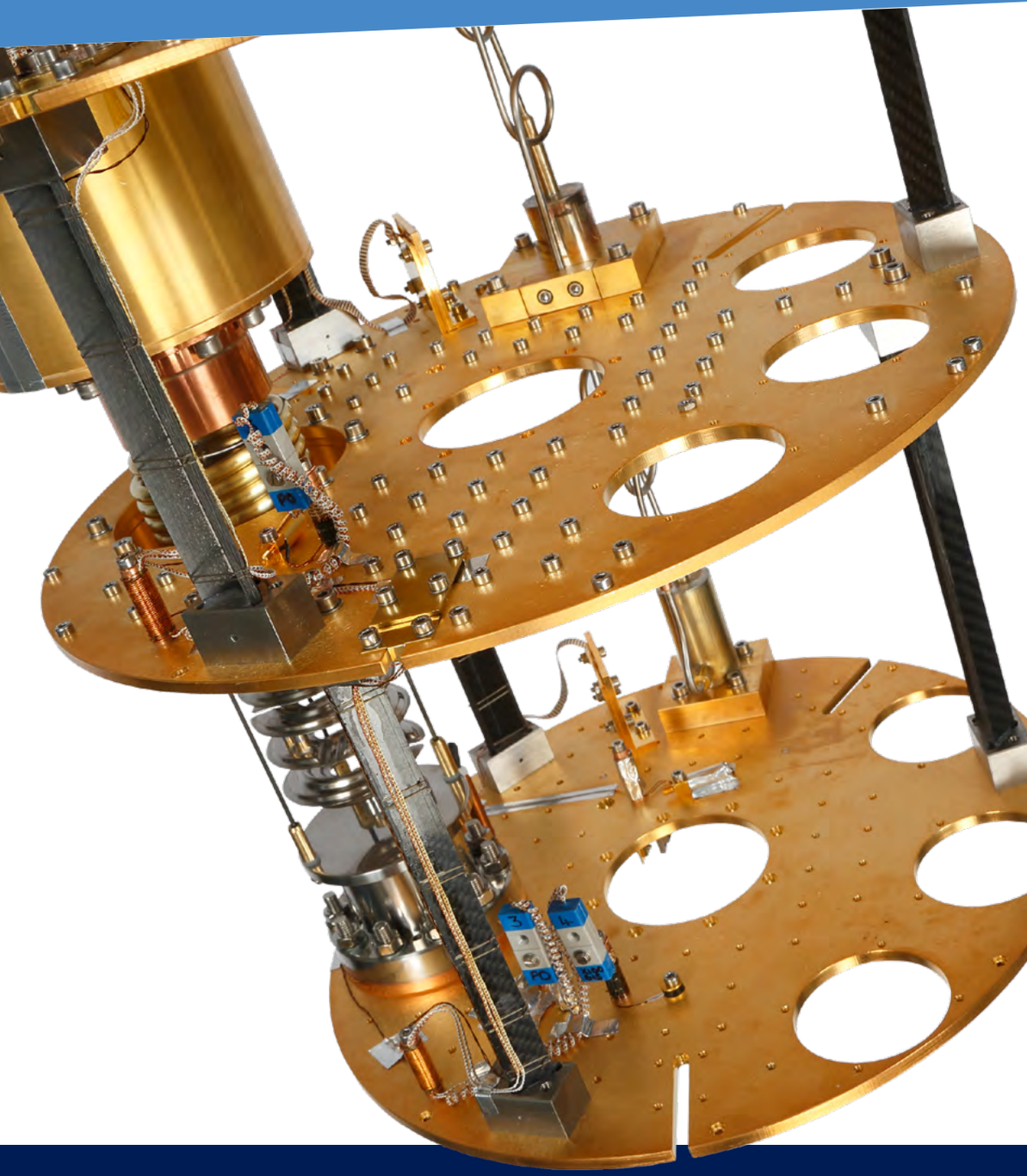
New imaging solution for cellular responses to stimuli



A novel high-resolution imaging technique was developed by Oxford Researchers for real time visualisation of wave fronts in cardiac tissue cultures, for the study of cardiotoxicity and arrhythmias.

This technique can be automated for the high throughput analysis of cell cultures and functional cell monitoring to understand the effect to stimuli during drug screening. It has additional applications in the characterisation of stem cells or stem cell derived myocytes.

FULL WEB PROFILE ▶



Superconducting Qubit Coupler

Quantum annealers like those built by D-Wave Systems Inc. are computers extremely apt in solving optimisation problems with potential performance levels significantly superior to traditional computing machines. (Denchev et al., Phys. Rev. X 6 031015, 2016).

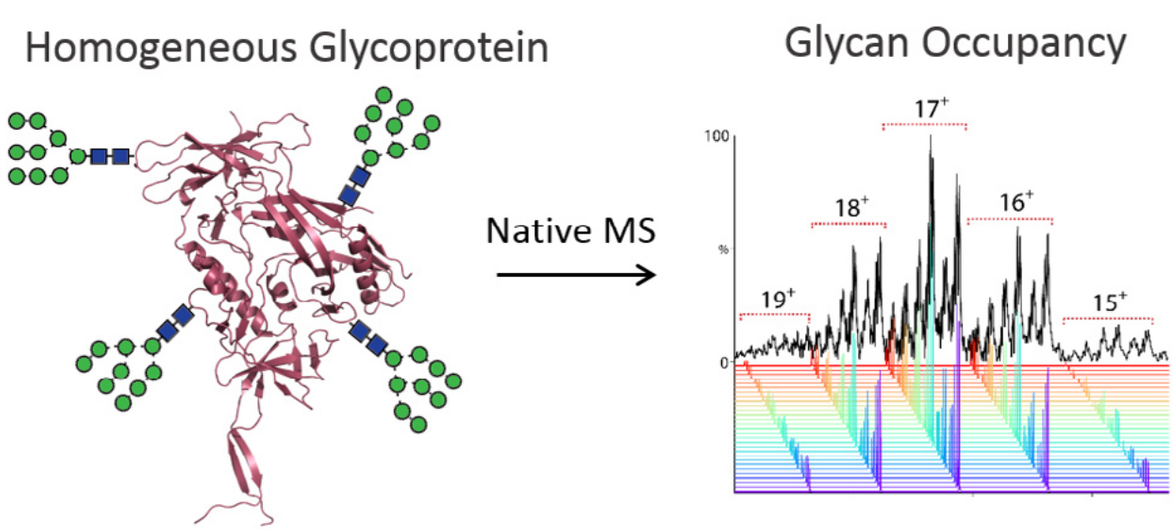
Current circuit designs for quantum annealers have limited connectivity and locality between qubits. This limits the number and type of problems that this class of quantum computer can solve. Researchers at the University of Oxford and University College London have developed a new circuit design that overcomes current limitations and can be used as a building block for the next generation of quantum annealers to enable them to solve problems of higher complexity.

FULL WEB PROFILE ▶

New technique to assess the quality of biotherapeutics

Quality control is one of the most important things to consider when manufacturing protein-based drugs, particularly due to the potential scale of its impact on their safety and efficacy. Monitoring the quality of a drug can easily change during manufacturing due to new processes, site transfers or scale changes. Most biologics in the market are glycoproteins, and their activity can be assessed in part by measuring the occupancy of their glycosylation sites. Furthermore, characterising these glycosylation features is a requirement of both the FDA and EMA to approve a biological drug.

Researchers from Oxford University have developed a technique that allows direct measurement of the number of N-glycans on a biotherapuetic molecule, using a combination of protein engineering and accessible mass spectrometry techniques.



FULL WEB PROFILE ▶

Brain games for primary schools

For decades, scientists and engineers have studied the complex mapping of the human brain. Understanding how the brain functions and handles tasks in the spatial and temporal domains is often not understood by adults, let alone primary school children.

Oxford academics are hoping to inspire the next generation of young scientists by developing games and teaching aids that will educate primary school children in the scientific study of cognitive neuroscience. Teachers and experts in primary science education helped to design a range of interactive board games which explain how the brain functions and relates to specific psychological processes and behaviours. The games are designed to improve cognitive abilities and encourage decision making.

FULL WEB PROFILE ▶

Next generation tactile feedback systems

Haptic technologies recreate the sense of touch by mechanical or electrical means. This approach has many applications, from video games and virtual reality to robotics and medical research. The key to addressing this diverse market is to make the haptic solution as versatile as possible.

Oxford researchers have developed FieldSense, a haptic feedback technology based on the precise placement of magnetic nodes. The solution requires little or no electrical power and is easy to manufacture. This incredibly versatile and compact methodology can be applied to any of the haptic users mentioned above in addition to opening the door to new applications.

FULL WEB PROFILE ▶

Virtual Reality in Oxford

Oxford University academics are using VR to save lives, treat mental health conditions and unlock genetic secrets.

After many years in the wilderness, virtual reality (VR) is poised to have its breakthrough into the mainstream, with substantial enthusiasm about the near-term future of VR from a number of sources, including Oxford University.

Driving this support is the increased accessibility of VR. From the entry-level Google Cardboard and Daydream devices to Facebook's Oculus and HTC's Vive headsets offering the ability to turn your living room into a holodeck, there are now a number of different roads into VR.

CONTINUED ▶

The technology is being explored in different areas in media and entertainment. The New York Times and other news websites have begun producing 360 degree videos which can be explored with VR. In film, the Tribeca and Cannes film festivals heavily promoted VR this year, with the latter screening a VR movie by the Oscar-winning director Alejandro G. Iñárritu. Building on the success of Spiderman: Homecoming's accompanying VR experience marketing tool, advertising professionals are waking up to the potential of VR with an increasing amount of VR advertising startups appearing and gaining significant venture funding.

Although it's developing fast, gaming in VR currently has an early 90s feel to it: it takes ages to set up, the market is inundated with demos, and everyone is anticipating the launch of Doom VFR. Many observers are waiting for a "killer app" that makes VR a must-buy. Doom, Doom VFR's predecessor, was certainly that when it changed gaming forever in 1993. With Bethesda, which developed both the Fallout and Elder Scrolls series (both of which will have VR versions), behind the driving wheel of Doom VFR, the early adopters are eager to see if lightning can strike twice.

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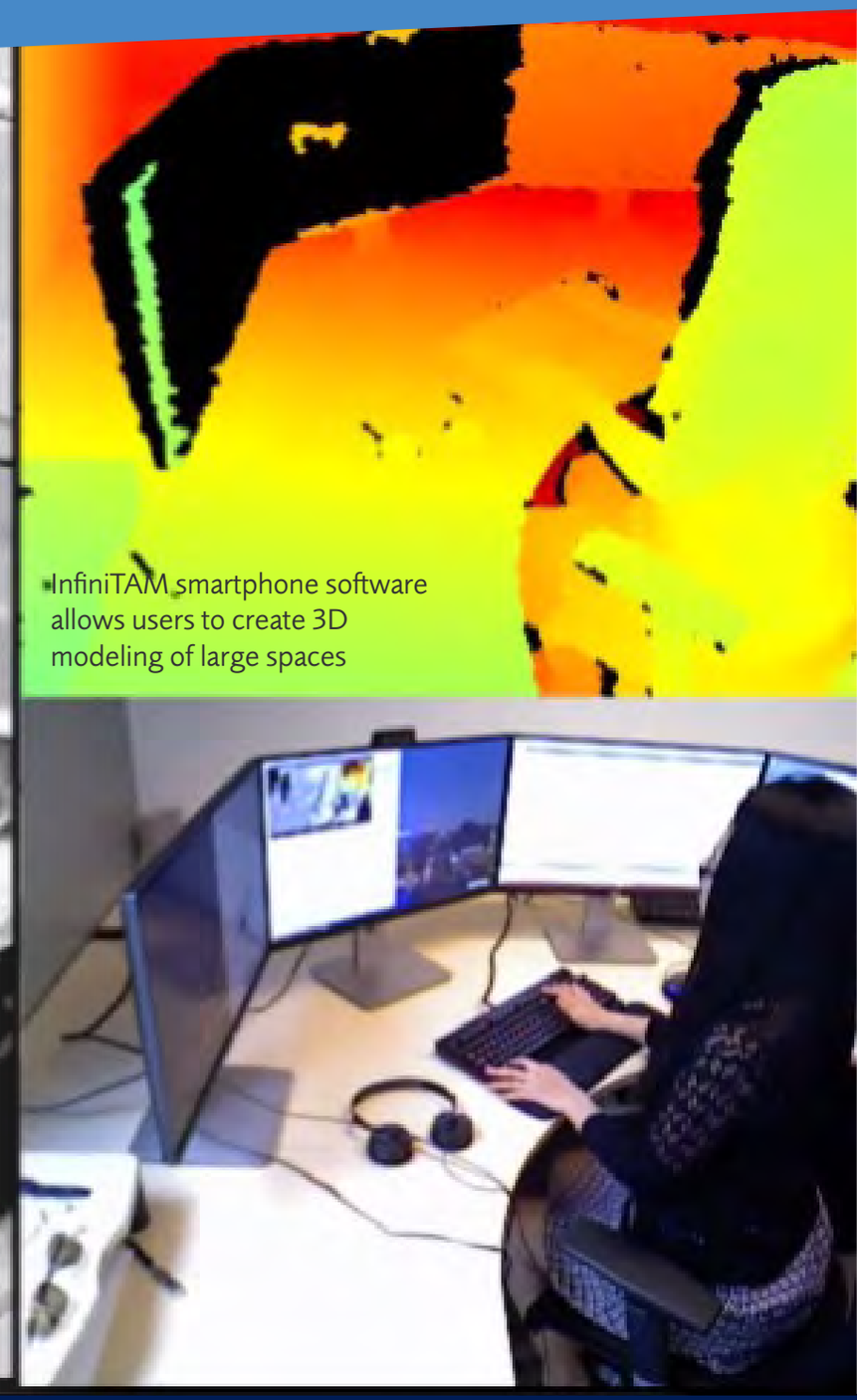


InfiniTAM smartphone software allows users to create 3D modeling of large spaces

Oxford University itself could be described as an early adopter of VR, although its focus is on practical applications that improve lives.

One of the shining lights in Oxford's burgeoning VR scene is the Life-Saving Instruction for Emergencies (LIFE) project. The first project to be financed by OxReach, the University's crowdfunding platform, LIFE raised £63,126 to develop a mobile app which can teach communities in developing countries essential techniques for saving lives. LIFE has since developed a VR element with support from the Vive's developer, HTC. Based on the Engage platform, developed by Immersive VR Education, LIFE's VR app is capable of educating up to 30 people simultaneously in life saving techniques.

While in VR, users are able to interact with medical apparatus and get live feedback from the instructor on their use. At present, the learning platform focuses on how to save a dying infant, but the team plan to expand the scope of what can be taught through LIFE.

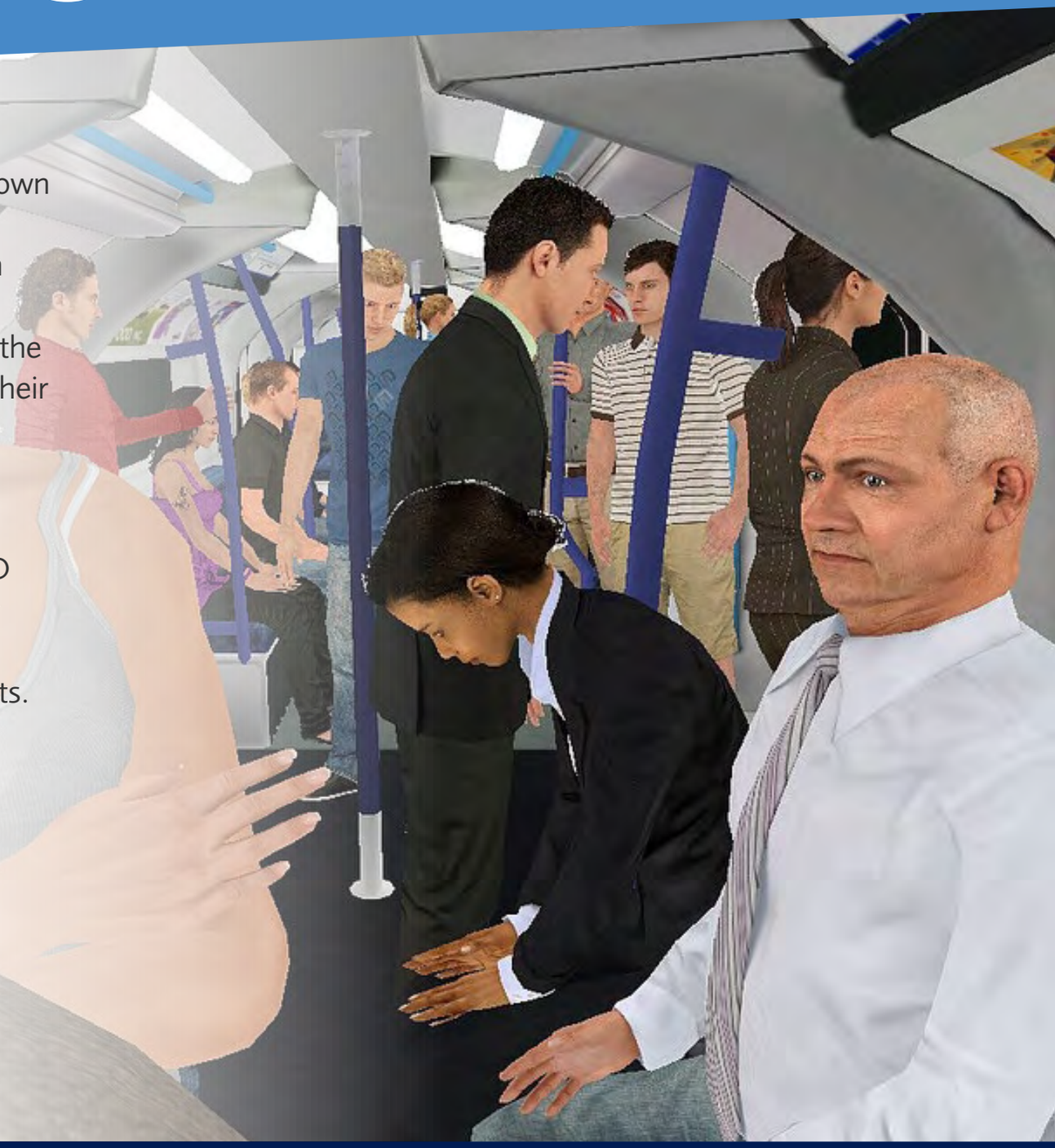
Mental health is the focus of Oxford VR, a spinout OUI supported the creation of in early 2017. The academics behind Oxford VR are using the technology to create safe environments for people with anxiety and phobias to interact with stressful situations. The team hope that by interacting with their fears in a virtual world, Oxford VR will help people have the confidence to overcome them in the real one. Oxford VR is still in development, with an official public launch planned for the coming months.

CONTINUED ▶

Another project in the works is InfiniTAM, which has the potential to break down the barriers to potential developers getting into virtual reality. A particularly labour-intensive part of developing a VR experience is designing the world in which it sits. With InfiniTAM, anyone with a smartphone will be able to turn their camera into a tool for creating those worlds. Users simply need to go to the location they wish to use, take out their phone, and use InfiniTAM to record their surroundings.

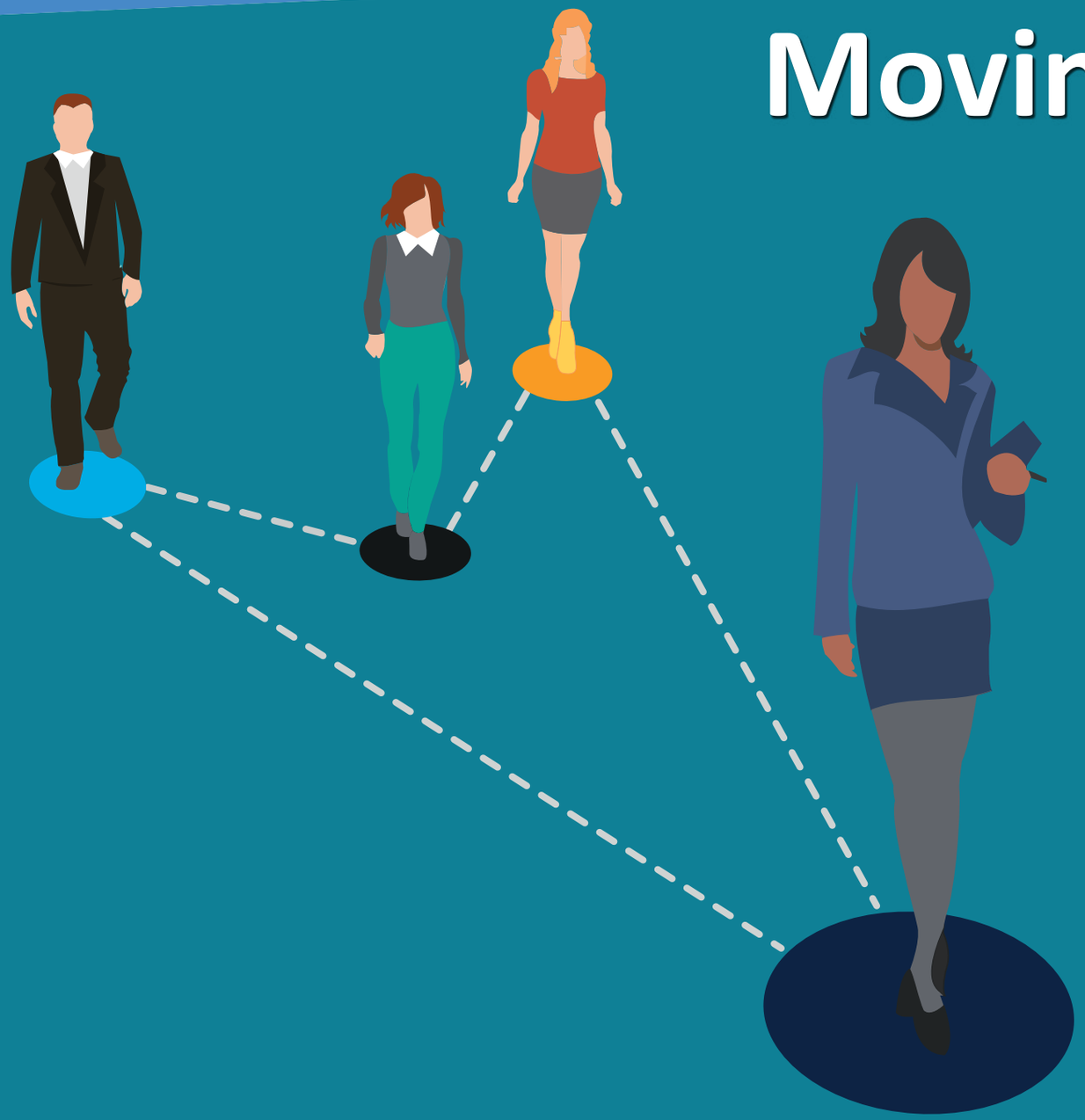
Academics are also using VR to visualise their data. A team of researchers, working collaboratively with Universita' di Napoli and Goldsmiths University of London, have designed a programme which allows users to see DNA in 3D space This is critical for understanding how DNA folding can impact whether genes can be switched on or off – a process which will help increase our understanding of the causes of disease, and potentially lead to new treatments.

These projects are just the tip of the virtual reality iceberg at Oxford. To further explore what's going on in VR around campus, we will be hosting the first Oxford Innovation Society (OIS) themed event around VR on the 21st September. (invitation only)



Further information on LIFE ▶

Further information on InfiniTAM ▶



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INNOVATION insights

OXFORD INNOVATION SOCIETY 2018

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

- Thursday 15 March
- Thursday 21st June

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

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