INNOVATION insights

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

ISSUE 16 FEBRUARY 2021

OXFORD'S CLEANTECH OFFER

Oxford's contribution to COVID has been a vaccine that will save the world – but what can we offer for the climate?

Other articles include:

Real world arsenic detection ▶

New needle for the extraction of oocytes ▶

A novel immunisation methodology ▶

A mathematical method to detect stress ▶

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Building back better

Just a slogan, or a manifesto for innovation?

Our collective response to the pandemic that has transformed the world, at unimaginable human cost, has been a potent mix of fear, anger, disbelief and bewilderment. People of all ages, everywhere, have struggled to comprehend what it means for them now and in the future. Amidst the chaos and uncertainty there has also been determination to do all we can to control and overcome the Covid-19 virus. The pioneering researchers and inventors behind vaccines, diagnostic tools and therapies deserve recognition for providing the prospect of a return to something like normality, after the devastation.

Minds are now turning to the 'what next?' question. Yes of course we should build back better, we should be better prepared for unlikely but catastrophic scenarios, and should work towards a sustainable relationship with the natural world. This is perhaps one answer to the 'what next?' for University research – the effect of climate change on the inhabitability of our planet was already an urgent issue pre-Covid, and now we're seeing a surge of interest in the technologies and research that Oxford generates to address that challenge. Scientific researchers and social sciences policy experts offer leadership for a cleantech future, with a growing portfolio of spinout companies in the sector demonstrating the real-world applicability of academic endeavours. You can read more about this in the feature article in this issue.

Oxford has led the way with technologies, and particularly the vaccine, that give hope for relief from Covid-19. Our spinout portfolio (which raised more than £1bn in 2020) evidently provides technologies and services that society wants and needs. From this foundation we look forward to Oxford once again providing innovative and sustainable solutions that restore our relationship with the natural world and contribute to the health and wealth of society.

With best wishes from everyone here at OUI, we hope you stay safe and well.

News

PerkinElmer
For the Better
Oxford Immunotec

Oxford diagnostic company is acquired
American global corporation PerkinElmer expands its global diagnostics reach by acquiring Oxford Immunotec for $591 million.

FULL ARTICLE ▶

Oxsed

Prenetics offers rapid, accurate, and scalable COVID-19 testing
Oxsed, a social enterprise developing affordable RaViD Direct testing has been acquired by Hong Kong-based life sciences company Prenetics.

FULL ARTICLE ▶

Oxbotica secures Series B funding
Autonomous vehicle company Oxbotica will use the funds to develop its universal autonomy platform in a round led by BP Ventures.

FULL ARTICLE ▶

Breakthrough drug technology
Oxford spinout PrOXisense has developed a new testing platform capable of identifying counterfeit drugs and vaccines.

FULL ARTICLE ▶

Real world arsenic detection

Arsenic is a naturally occurring element widely distributed in the earth's crust and a common contaminant of drinking water. Exposure to arsenic can cause a variety of adverse health effects including dermal changes, respiratory, cardiovascular, gastrointestinal, and carcinogenic effects.

Using novel modified glassy carbon electrodes, electrochemical techniques have been developed which allow low levels of arsenic contamination in water samples containing high levels of Cu(II) as a co-contaminant to be detected.

FULL WEB PROFILE ▶

A novel immunisation methodology

Immunisation stimulates an individual's immune system to increase resistance to specific pathogens. The theory behind the process of immunisation has been known for centuries, but the general systemic nature of vaccines has remained unchanged.

Oxford researchers have developed a novel, targeted approach to immunisation wherein a generalised T-cell response is initiated with a traditional-style vaccination route (e.g. intramuscular) before the T-cells are targeted to a specific organ. This "prime and target" approach has shown 100% efficacy against murine malaria where the T-cells are targeted to the liver using an intravenous boost.

FULL WEB PROFILE ▶

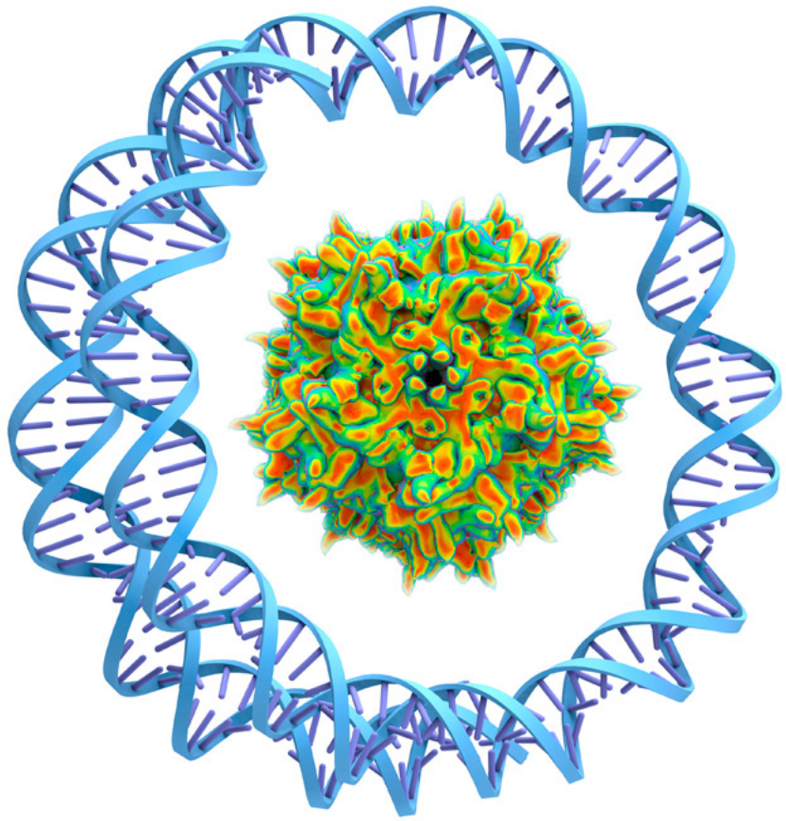
An Innovative Collaboration with the Department of Oncology

OUI's Consulting Services team is collaborating with the University of Oxford's Oncology Department on an innovative new approach that formalises and strengthens the relationship Oncology has with its industry partners.

The Department of Oncology's staff, small research facility leads, and spin-out founders, all worked together with OUI to develop a new framework for industry partnerships. It includes a standard operating procedure for all commercial collaborations within the department, model service contract templates, and a model agreement for equipment access. In 2020 this framework was successfully utilised, increasing the reach of equipment and expertise in support of life-changing cancer-research across the world. The collaboration was nominated for the Vice Chancellor's Innovation Award and was published as an impact case study by the University of Oxford.

FULL WEB PROFILE ▶

Gene therapy for chronic pain and epilepsy



Current treatments for chronic pain and epilepsy do not fully satisfy all clinical needs. In the case of chronic pain, epidemiological data shows that one in five adults is affected despite use of current analgesics. This has a major impact on an individual's quality of life, limiting their functional status and, as reported in a US study, resulting in huge economic costs, much greater than those attributable to heart disease or diabetes.

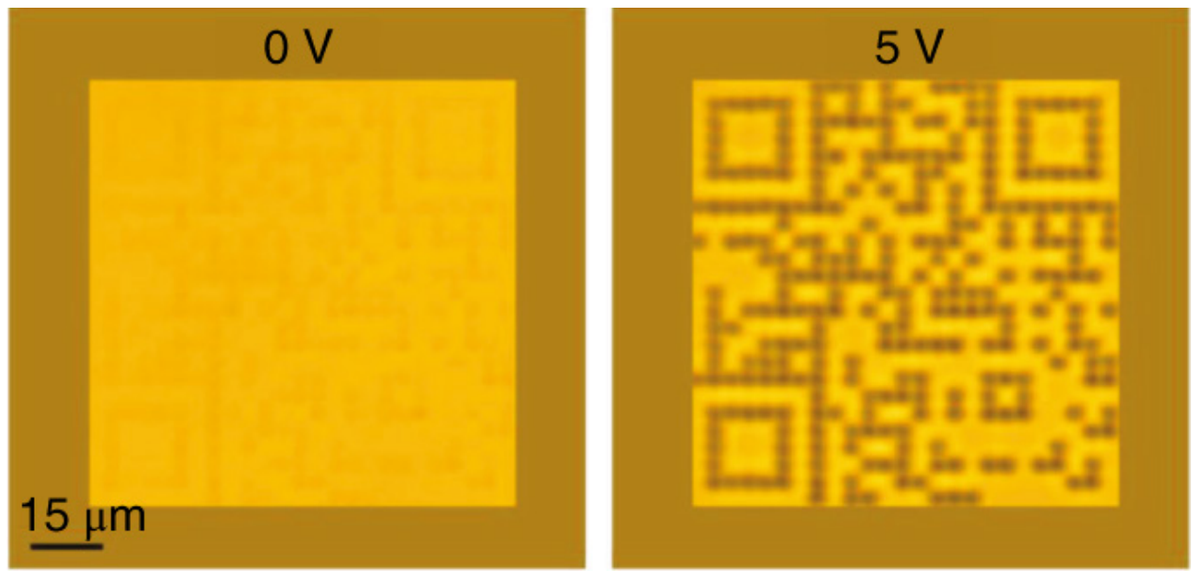
Researchers at Oxford have developed a potential new treatment that comprises an adeno-associated virus (AAV) based gene therapy delivering the CASPR2 (contactin associated proteins 2) gene to sensory neurons. In experimental models, the resultant overexpression of CASPR2 has so far yielded promising results and further studies are ongoing. Patent protection has been sought for the invention and Oxford University Innovation is now interested in entering licensing discussions with potential corporate partners.

FULL WEB PROFILE ▶

Read-on-demand features in liquid crystal devices

Researchers at Oxford have devised a method to lock-in complex liquid crystal (LC) profiles which can appear or disappear controlled by one, simple voltage application.

This is achieved through in-situ fabrication of polymeric structures with a selected liquid crystal state within a LC device, and subsequent application of electric fields of varying strength. This invention allows the state of only a proportion of liquid crystal material to be changed without the need for multiple electrodes. Applications include hologram and diffractive optical elements.



FULL WEB PROFILE ▶

A diagnostic approach to identify patients with CASPR2 autoantibodies

CASPR2 autoantibodies are detected in the serum of patients with a range of neurological disorders, including neuromyotonia, Morvan's syndrome, epilepsy, and forms of encephalitis. More than 95% of patients with CASPR2 autoantibodies show a marked clinical benefit from immunotherapies. However, it is recognised that several patients with CASPR2 autoantibodies do not have an immune-mediated neurological syndrome and will not respond to immunotherapy.

Researchers from the University of Oxford have developed a combined diagnostic approach using both serological and genetic testing to identify which patients with CASPR2 autoantibodies will respond positively to immunotherapy. This improved stratification of patients will prevent expensive and potentially toxic immunotherapies being given to patients unlikely to respond positively and will help encourage more confident management of those who are likely to improve using immunotherapies.

FULL WEB PROFILE ▶

Solar-powered efficient photocatalytic ammonia production

With a growing world population, we currently face the challenge of producing food in a more sustainable manner. Ammonia-based fertilisers are important chemicals for crop growth that supports food production for over 48% of the world's population. The ammonia production still relies on the centralised Haber-Bosch (HB) process. Although such process has been critical for the development of modern agriculture, it is also extremely carbon intensive accounting for 1.8% of the global CO_2 emissions.

Inspired by nature, Oxford academics have developed a novel photocatalyst that allows the conversion of nitrogen into ammonia under mild conditions and visible light intensities. Not only the methodology allows for a more sustainable production of ammonia, but it also opens the door to its decentralisation.

FULL WEB PROFILE ▶

A method to extract oocytes during IVF

In vitro fertilisation (IVF) aims to help couples struggling to conceive have a baby. Oocyte retrieval is an intrinsic part of IVF and the number of oocytes (eggs) collected has been directly correlated to the live birth rate. Follicular flushing is a three-step process aiming to boost oocyte yield. A dual-channel needle is used to perform follicular flushing and all existing needles are broadly of similar design. Importantly, a recent meta-analysis has shown no improvement in oocyte numbers or indeed live births with follicular flushing.

Scientists at the University of Oxford have designed a new type of dual-channel needle for the extraction of oocytes during the IVF process. The needle has the potential to increase oocyte yield and causes less damage to the oocytes during the collection process. This could revolutionise IVF by significantly increasing the live birth rate.

FULL WEB PROFILE ▶

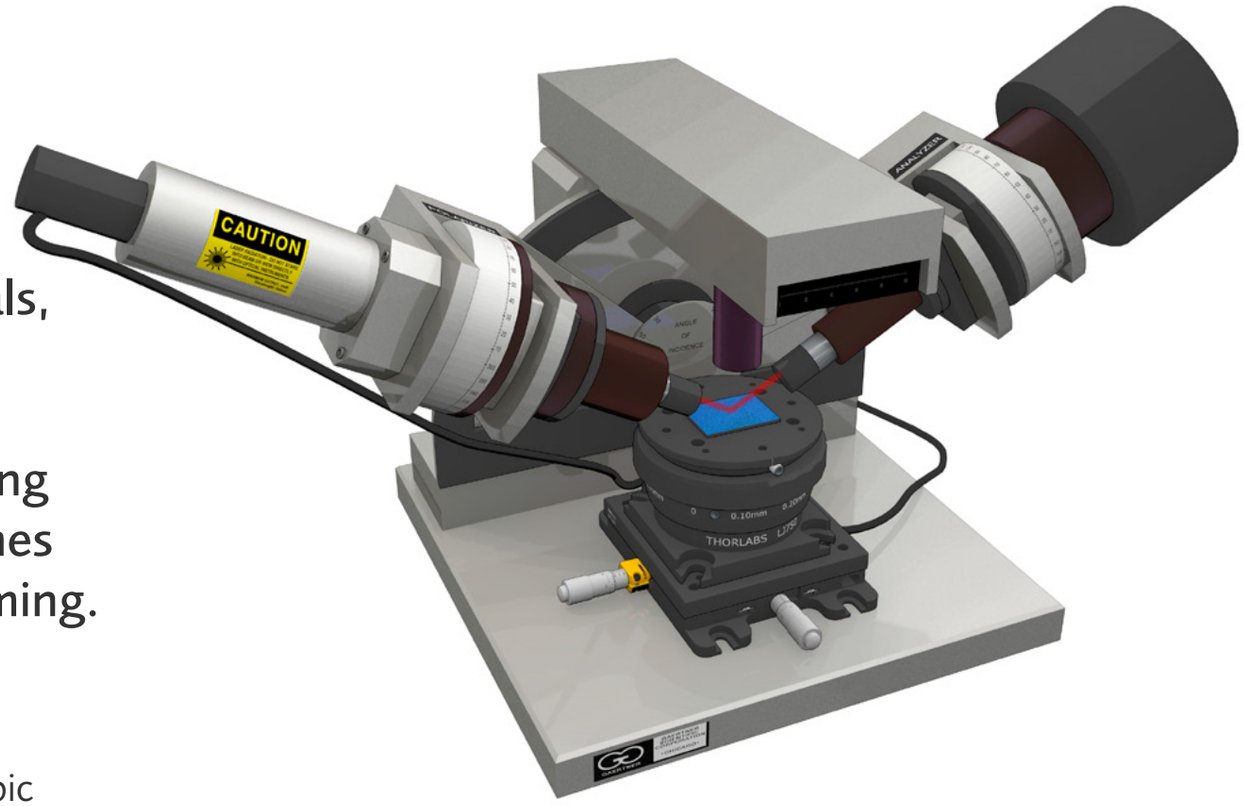
A mathematical method to detect stress

Current mathematical models can analyse physiological signals in separate intervals. Oxford researchers have developed an algorithm which allows multiple signals to be analysed together over a defined period.

Analysing the signals in this way extracts more information regarding the individual's state and reduces the risk of misdiagnosing. This technology can be implemented into a device to detect stress levels as well as other physical and emotional states that would add value to health and fitness systems.

FULL WEB PROFILE ▶

Real-time ellipsometry analysis and quality control of thin films



Ellipsometry is an optical technique used to characterise properties of thin films such as thickness, roughness, optical constants, composition, crystallinity, quality, and concentration. In the study of mono-layered materials, these properties can be measured by fitting certain parameters, such as refractive indexes, into a model. However, when studying complex multi-layered absorbing materials such as semiconductors, model analysis becomes challenging, computationally expensive and time consuming.

Researchers at Oxford University have devised a quick, low-cost method to monitor dynamic changes and quality of multi-layered thin films during manufacture. The method enables in-situ, real-time analysis of spectroscopic ellipsometry data throughout each layer's deposition.

FULL WEB PROFILE ▶

Oxford's cleantech offer

Oxford's contribution to COVID has been a vaccine that will save the world – but what can we offer for the climate?

Oxford's response to COVID-19 has been an excellent demonstration of what the institution is capable of when it sets its mind to a task. The institution has produced multiple high profile research papers on the pandemic, created companies geared to tackling ventilator shortages and rapid COVID testing, and has delivered an affordable, effective vaccine against the coronavirus for the whole world.

As a result, many in the University and the surrounding area are asking, what's next?

While the pandemic dominated the headlines in 2020 (and continues to do so), the climate crisis has not gone away. Even as the pandemic took hold, Australia was on fire and was followed up by similar blazes in the United States. The Atlantic Hurricane Season 2020 was the busiest and one of the costliest on record. NASA has said 2020 narrowly beat out 2016 as the hottest year to date. And as 2021 settles into its groove, our relationship with the planet has only become even more pressing.

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Meanwhile, many governments (including now the United States) are increasingly discussing building back from COVID-19 with a green agenda. As a result, many cleantech firms are seeing a surge in interest and stock prices, with notable rises for energy and electric vehicles firms from 2020 carrying on into the new year.

As such, many are predicting that 2021 will be the year of clean and climatech.

Here in Oxford, we have been building a robust portfolio of companies either directly or partially involved in cleantech. Of the over 250 companies we've created across all sciences, our analysis shows that 24 are active in this space. And with record levels of investment coming into Oxford (over £1bn into our spinout portfolio in the calendar year of 2020 alone), we expect our cleantech portfolio to continue to scale in the year ahead.

A good portion of our companies are directly focused on energy production itself, including fusion firm First Light Fusion and next-gen solar company Oxford PV.

Founded to address the urgent need for a readily available and reliable source of clean energy, First Light Fusion is working towards delivering fusion energy over the next decade. Following an investment of $25m in December 2020, the company has completed upgrades to its "Machine 3" – capable of discharging 200,000 volts and in excess of 14 million ampere (equivalent to nearly 500 lightning strikes) within two microseconds.

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The next step for the company will be demonstrating "gain" (ie. more energy created in the reaction than it takes to generate it) in the coming years with plans to open a plant in the 2030s.

Meanwhile, Oxford PV is drawing on an already functioning fusion energy plant – the Sun – with its next generation perovskite solar cell technology. At present, silicon-based solar cells have conversion rate of turning sunlight into electricity of around 15-20%. Following the unveiling a research programme to take its technology to 37% efficiency over five years in 2018, the company has been going from strength to strength, raising £65m during 2019. Closing out 2020, Oxford PV demonstrated the fruits of its labour to date, setting a new record for solar technology with a 29.5% conversion rate, and plans to begin selling its products to the public in 2022.

Energy production isn't the sole focus of OUI-supported ventures, however. YASA Motors, a producer of engines for electric vehicles, recently opened a new plant for production of its motors and is helping Ferrari produce its first e-supercar. Our automated vehicle technology firm Oxbotica continues to develop its technology with a view to deploying it in industrial settings, and recently secured $47m in its Series B. Smart boiler firm Mixergy signed a deal recently with Centrica and British Gas to install smart boilers across the UK which collectively work to reduce bills and energy demands.

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Underpinning these already existing companies is a healthy pipeline of intellectual property for the next wave of cleantech technologies for licence, academic consultancy, and OUI-supported ventures. In energy, we have more renewable energy solutions on the way, including more fusion, as well as storage and efficiency technologies. We have sustainable materials and chemicals in development, as well as multiple transport-related IPs in hydrogen, sustainable fuels, and electric vehicles. We're also seeing an increase of IP in water, carbon capture and recycling coming to bear.

"Oxford University's cleantech innovation focuses in five main areas including energy, transport, sustainable materials, environmental recycling as well as natural resources such as water," said Jane Jin, Senior Licensing and Ventures Manager at OUI. "From OUI's initial IP mapping exercise, we found our core cleantech IPs are generated from University's word-leading research in hydrogen generation, energy storage, waste recycling solutions and carbon capture and storage technologies."

Our response to the climate crisis, similar to COVID, draws on both the depth and breadth of Oxford's expertise across the sciences. Our Chemistry and Physics departments, both prolific creators of spinout companies, are heavily invested in this area, as are our Engineering Science and Materials departments. Computer Sciences, Earth Sciences, Zoology, the Mathematical Institute and the Oxford Robotics Institute are also producing cleantech IP.

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We also have a solid community within social sciences in the Environmental Change Institute, Smith School, the Oxford Martin School, Geography and Transport Studies Unit which are collaborating on research and policy.

The sense on the ground here is that Oxford has a great deal to offer to the global effort on tackling climate change, and the University is increasingly investing time and resources into translating our ideas into impact. Here at OUI, we are fully committed to supporting the University and our companies into realising this vast potential, and are currently discussing ways we can accelerate development of this world-leading research while bringing more collaborators and investors into our cleantech network. We're also continuing to assist our world-class academics with consultancy to organisations outside of Oxford, and aim to continue our record breaking streak of company creation, which saw 28 firms created in 2020.

The challenge ahead is sizeable, perhaps the biggest we've faced as a civilisation. Yet if the pandemic demonstrated anything, it is that Oxford and its peer institutions can have a sizeable impact in solving the world's biggest crises, and we stand ready to deliver once again on climate.

INNOVATION insights

IMPORTANT NEWS
FOR OUR OIS MEMBERS

Considering the Coronavirus outbreak and the current UK Government advice, Oxford Innovation Society (OIS) meetings are currently on hold.

We are preparing alternative means of engagement and will communicate details to members once arrangements have been made.

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

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