



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

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

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

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

Email : enquiries@innovation.ox.ac.uk

Ii

Issue 64 Summer 11

Isis insights

The latest innovations, collaborations and technology transfer



Conservation & creation

Research and the environment



ISIS
INNOVATION

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Isis Enterprise's global reach



It is produced by Isis Innovation Ltd, the technology transfer company owned by the University of Oxford. To receive your free copy of Ii, email innovation@isis.ox.ac.uk www.isis-innovation.com

Isis results

The highlights for the year to March 2011 show our income up 13% to over £8.4 million, with transfers to the University and its researchers of £4.8 million, reflecting a very successful year in challenging circumstances. We are working with more academics and researchers – in Oxford and around the world – protecting more IP, signing more IP deals, setting up new companies and helping universities and business to work together more closely. The Isis 2011 Annual Report will be published in September.

Oxford Innovation Society heads to China

For the first time in its 20 year history, the Oxford Innovation Society is holding an event outside the UK, in Hong Kong in July. Invited guests from the region's business, government and university communities are gathering to develop connections with Oxford and Isis. Following the OIS event, attendees are also invited to join 150 other delegates at the Kuang-Chi Institute and Isis Innovation, University of Oxford, International Technology Innovation Conference in Shenzhen. The events herald the expansion of our activities in Hong Kong and China. Isis' Dr David Baghurst is moving to Hong Kong to lead the continued development of our activities in the area, together with Ya-hsin Shen who has been working for Isis as a consultant.

Technology Transfer: New Isis Outcomes products

The May 2011 International Society for Pharmacoeconomics and Outcomes Research (ISPOR) event in Baltimore provided the platform for the launch of three new Isis Outcomes products: the Manchester/Oxford Foot and Ankle Questionnaire (MOxAFQ), the Myocardial Infarction Dimensional Assessment Scale (MIDAS) and the Oxford Shoulder Score (OSS). Isis Outcomes offers a growing selection of health outcome and Patient-Reported Outcome measures (PROs) to global healthcare clients, for conditions such as Parkinson's, Endometriosis, Orthopedics and Motor Neurone Disease/Amyotrophic Lateral Sclerosis (ALS). Isis Outcomes reflects the breadth of Isis' business activities, commercialising research outcomes from across Oxford's world-class research base.

Oxford University Consulting expertise

Academic consulting is a great way for businesses to benefit from the expertise available across the academic community in the University of Oxford. Oxford University Consulting (OUC) has been part of Isis for over 10 years, helping clients identify and access Oxford academic expertise. OUC helps client organisations and wider society, develops relationships offering research opportunities and assists research and teaching. This Isis division also provides evidence to demonstrate research impact, along with providing a financially rewarding channel for academics. See [page four](#) for the latest engagement for OUC, helping Laing O'Rourke access expertise from the University's Department of Engineering Science.



The latest news
from **Oxford**
University
Consulting and
Isis Enterprise

The

Loop

OUC signs Master Framework Agreement with Laing O'Rourke

LAING O'ROURKE

Over the last few years, OUC has had considerable success in assisting academics and researchers in the Department of Engineering Science with their personal consulting opportunities. In recognition of the good work already done, OUC – at the end of October 2010 – was asked to assist the Department of Engineering Science in strategic discussions that could result in a major agreement between the University of Oxford and Laing O'Rourke, a global engineering and construction group. An integral part of this agreement would be a Master Framework Consulting Agreement that would allow Laing O'Rourke to access the University's expertise.

Earlier this year, at the Divinity School in Oxford, these discussions

A new engineering centre is focusing on interdisciplinary research relevant to the construction industry.

culminated in a joint announcement from the University of Oxford and Laing O'Rourke regarding the establishment of a new centre for engineering. The centre is focusing on interdisciplinary research relevant to the construction industry and framework agreements were concluded covering consulting, intellectual property and professional development through accredited courses.

Working closely with the University's Legal Services Offices and Research Services, OUC was able to put in place an agreement that would allow the five business units of Laing O'Rourke to access world class expertise, not only in civil and materials engineering, but also a much wider range of subjects in the physical sciences from Oxford.

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Isis Enterprise workshops support local businesses

In conjunction with the Oxfordshire Innovation and Growth Team (IGT), Isis Enterprise are holding a series of innovation workshops to support local businesses in their innovation management processes.

During the first of these events, held in March at the Milton Park Innovation Centre, attendees heard why they should consider protecting their own Intellectual Property (IP), what can be protected, and how it can then be exploited. Tax advantages of patenting and IP commercialisation were also considered.

Subsequent events, to be held over the next few months, will focus on innovation management, licensing and negotiation, and product development for small businesses. International commercialisation, with a focus on the Chinese market, will also be a major theme.

Through its work with the Oxfordshire IGT, Isis Enterprise continues to build strong links with local industry and plays a role in stimulating the local economy.

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The Portfolio



Intelligent Ultrasound: A more complete picture

Medical ultrasound is the most commonly employed diagnostic imaging tool in healthcare. It is used widely and routinely in the fields of obstetrics, cardiology, general radiology and surgery, and benefits many millions of patients around the world each year. Medical ultrasound requires trained professionals (sonographers) to undertake each scan, which is subsequently reviewed and reported on by a physician. Medical ultrasound is not without its limitations and there is a demonstrable need to improve image quality, increase the field of view from a single scan, and to assist users in learning how to work with the technology.

Addressing these needs will markedly increase the value and global uptake of medical ultrasound. It is widely accepted that hardware solutions are close to the limit of their capabilities and that software therefore holds the key to future developments and improvements in medical ultrasound image quality and diagnostic value.

Engineers from the Institute of Biomedical Engineering (IBME) at Oxford University, led by Professor Alison Noble, have developed and proven a software platform (3D Fusion Ultrasound) that significantly improves the image quality, field of view and consequent diagnostic power of ultrasound scans. 3D Fusion Ultrasound can be used in all key medical applications where ultrasound is currently used.

Intelligent Ultrasound, a Company set to spin-out of the University of Oxford, will focus on two core product development workstreams: information content and quality assurance. The products developed within the information content work-stream will focus on image quality and field of view

improvements for ultrasound imaging in cardiology, obstetrics and surgery. The focus of the quality assurance work-stream is to provide software tools that help hospital staff improve the quality of imaging service they provide and reduce the risk of wrong or missed diagnoses in obstetric and cardiac ultrasound scans.

The 3D Fusion Ultrasound software will be sold to manufacturers of ultrasound scanners as a plug-in (effectively forming part of the host software), a standalone application (resident on the machine, but separate to the host software) and as a licensed download for use on a doctor's personal computer. The software will also be available for use in image review and reporting workstations, and hospital picture archiving and communication systems (PACS) that are routinely used for off-line analysis and reporting in all developed healthcare markets.

The company's 3D Fusion Ultrasound software is already in clinical use in multiple clinical sites in the UK and overseas. Now, the quality assurance work-stream will develop and commercialise the company's IntelligentQA software and service package. This will enable hospitals and clinics to improve the overall quality and diagnostic power of the ultrasound service they deliver, reduce the risk of wrong diagnoses or missed diagnoses and their consequences, and reduce the need for and cost of recalling patients for rescans.

Using the IntelligentQA software, hospitals and clinics will be able to monitor sonographer performance, identify training needs and take remedial action where necessary to ensure they provide a continuously improving ultrasound scanning



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service. The development of this software is at an advanced stage and is already in use as part of a major international study into fetal development.

Intelligent Ultrasound is currently looking for £750,000 to implement its commercialisation strategy. It is anticipated that the fundraising will qualify for Enterprise Investment Scheme (EIS) relief. The CEO and co-founder of Intelligent Ultrasound, Andy Hill, will be participating in the funding round and has committed to invest £50,000.

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Technology Steps Forward

SMEasure secures licenses in California and London



A free web-based energy management system tool is debuting in California, after the Isis Software Incubator secured licensing deals with Fourth Sector Strategies and Sierra Business Council in the Sierra Nevada.

SMEasure, which stands for Savings by Monitoring Energy, is a tool that allows users to maximise the benefits of new smart meters. The Isis Software Incubator is a new Isis initiative offering IP advice and mentoring to emerging software ventures originating from the University of Oxford.

Developed by energy researchers from Oxford's Environmental Change Institute, SMEasure provides businesses with state-of-the-art weather and energy analysis to prevent energy waste, leading to significant monetary savings.

Fourth Sector Strategies and Sierra Business Council are using SMEasure with businesses from California participating in the Innovator Pilot, which is being supported by utility provider Pacific Gas and Electricity (PG&E). SMEasure enables PG&E customers to use their smart meter energy data, recorded at 15-minute intervals, to obtain informative analysis and recommendations for energy saving.

"One huge benefit for users in the Sierra Nevada is the link to programmes, rebates and resources that can help them upgrade their facilities," said Emma Ingebreetsen,

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The Isis Software Incubator is a new Isis initiative offering IP advice and mentoring to emerging software ventures originating from the University of Oxford.

Energy Associate for the Sierra Nevada Energy Watch.

SMEasure is designed to fit the needs of many businesses – from those with just a single building to those with a portfolio of buildings – in monitoring their energy.

Any type of commercial building can use SMEasure. In return for spending five minutes a week recording their energy meter readings, users get highly informative visual feedback on their energy use, cost, emissions and efficiency performance.

The software has a unique community feature allowing businesses to access further support in terms of energy saving.

More than 500 buildings around the UK are already using SMEasure, including those in the five London Boroughs participating in the Low Carbon Zone initiative.

The continued focus of 2011 will be to expand SMEasure in both the UK and US.

Weblink

www.smeasure.org

Isis agrees augmented reality deal

Isis Innovation has licensed Parallel Tracking and Mapping (PTAM) software to 2D3, an Oxford based company which delivers imaging exploitation technology to extract, manipulate, combine, create and enhance video footage. 2D3 utilised PTAM along with considerable in-house expertise to deliver a prototype to the UK Ministry of Defence.

Augmented reality (AR) combines a live view of a physical real-world environment combined with virtual, computer generated images creating a mixed (augmented) view. The Oxford PTAM software is a camera tracking system that establishes a ground plane (or any other horizontal surface) in a real-world video feed, which can be used to supplement the live image with stable 3D augmentations. The software requires no markers, pre-made maps, scene templates, or inertial sensors.

The project aims to enable a user to freely explore a building and add non-destructive annotations to locations of interest throughout the building. The annotations are virtual and visible using a hand-held computer with a camera. The annotations are located in 3D on the area of interest. Using augmented reality technology the annotations are overlaid on the video feed from the camera in such a way as to appear as if they are actually in the real world at the required location. The real time aspect allows a user to freely explore the space, viewing annotations from all angles, and enables them to form a better understanding of their real spatial layout.

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OUC helps JISC explore digital impact

A report written by an OUC consultant has been published which evaluates the impact of digital resources on research, teaching and wider society.

Written for JISC by Dr Eric Meyer of the Oxford Internet Institute, the study synthesises the outcome of the JISC impact and embedding of digitised resources programme. It looked at digital collections such as the University of Oxford's iTunes podcasts, which attract 1-2 million listeners from across the world daily.

Dr Meyer found that "A positive impact on wider society is evident in a number of digital resources, particularly those with content of interest to amateur historians, primary and secondary school students, and lifelong learners."

A Vision of Britain through Time has proved popular with local historians, *British History Online* is of broad interest to British history enthusiasts, and the *Old Bailey Proceedings Online* is frequently used by genealogists, Dr Meyer wrote in his report.

Fifteen recommendations were made on how digital resources can maximise their impact. These can be read, along with the full report online: <http://ssrn.com/abstract=1846535>

JISC is the UK's consortium for technology in higher and further education.

This report was particularly important to the work of JISC in terms of demonstrating the value of investing in scholarly digital content.

The University of Oxford has a wide range of experts who can offer consultancy. OUC facilitates the interaction between consultants and clients seeking expertise.

Weblink

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Technology Tactics

The Technology Strategy Board has a vital part to play in UK innovation. **Chief Executive Iain Gray** explains its role.



The potential for technology innovation to drive economic growth is enormous, particularly in the context of difficult economic circumstances and major societal and environmental challenges. Governments around the world have recognised this, and many have invested accordingly. In the UK, a major step forward in recent years has been the creation of the Technology Strategy Board, the UK's national innovation agency.

The Technology Strategy Board was originally an advisory body within the Government, but in 2007 it was established as a separate organisation – with a mission to support and stimulate technology-enabled innovation in order to accelerate UK business and economic growth.

We brought under one roof some specific support programmes which already existed, and added new approaches and mechanisms. Now, a portfolio of complementary tools helps businesses large and small to

innovate, bringing good ideas closer to commercialisation.

We work across government, business and the research community, removing barriers to innovation, bringing organisations together to focus on opportunities, and investing in the development of new technology-based products and services for future markets.

We operate in areas where there is a clear potential business benefit and where technologies can be applied – helping today's emerging technologies become the growth sectors of tomorrow. And we work closely with other bodies, combining and focusing resources and often co-funding activities with research councils, government departments and the devolved administrations of Scotland, Wales and Northern Ireland.

The words connect and catalyse describe our approach well; we bring organisations and individuals together in partnerships and collaborations, and we add support and investment – providing a catalyst for innovation which would otherwise happen more slowly or not at all.

Business can work with us in many specific ways – whether competing for research and development funding; joining one of the 15 Knowledge Transfer Networks to share information and ideas and find new contacts and partners; working with a college or university on an innovative project in a Knowledge Transfer Partnership; or gaining a contract from a Government department to develop an innovative product or service under SBRI, the Small Business Research Initiative.

The challenges facing society can become a powerful stimulus for innovation.

Challenge-led innovation

The challenges facing society can become a powerful stimulus for innovation. Whether carbon emissions, the ageing population or the need for sustainable food

Sitting between the worlds of academia and business, the centres will enable cutting edge research to be pushed forward and translated swiftly into commercial opportunities.

supplies, there are issues which governments need to address, and which therefore represent huge future markets for innovative solutions to these challenges. In several of these areas, where there is most potential, we have established 'innovation platforms'. The innovation platform approach brings together the main parties with an interest in the challenge – whether from business, policy or academia – to focus on the issue, apply the right mechanisms to accelerate innovation, and ultimately open up the business opportunities while helping to solve what are often global issues.

Technology and innovation centres

In October, the Prime Minister announced a new addition to the innovation 'landscape' – a £200 million investment in a new network of world-leading technology and innovation centres in the UK. This exciting project, building on some of the thinking in technology entrepreneur Hermann Hauser's recent review, represents a major investment in the future innovation ability of the UK. The Technology Strategy Board is responsible for setting up and overseeing the network.

Sitting between the worlds of academia and business, the centres will enable cutting edge research to be pushed forward and translated swiftly into commercial opportunities. Creating a critical mass of activity in their field, they will reach into the knowledge base for world-leading technology and expertise, undertake collaborative research projects with business or carry out contracted research, and allow businesses to access technical expertise, infrastructure, skills and equipment that would otherwise be out of reach.

In January, we published our prospectus outlining how we would go about establishing the network

of six to eight centres, and asked for input and suggestions from the business and research communities. The first in the programme, as announced in February, will be a collaboration between seven existing centres to form a technology and innovation centre in high value manufacturing, and the second will focus on cell therapies. As we develop this important programme there will be further announcements during 2011 and 2012.

Success breeds success

It is in business and in the research base that the actual work of innovation happens. The Technology Strategy Board can bring people together, facilitate, signpost, invest and support, but the entrepreneurial spirit in our boardrooms and labs, and the belief in the power of innovation, will be the key to the growth that we need.

The Technology Strategy Board is an executive non-departmental public body (NDPB), established by the Government in 2007 and sponsored by the Department for Business, Innovation and Skills (BIS). The activities of the Technology Strategy Board are jointly supported and funded by BIS and other government departments, the devolved administrations, regional development agencies and research councils. Further information on the Technology Strategy Board is available at www.innovateuk.org
Image courtesy of Stratophase

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Supporting Spin-outs

Oxford Innovation Society member Laytons Solicitors provide an insight into their role in spinning out successful companies. By **Esther Gunaratnam and Lisa McLean, Partners, Laytons Solicitors**



LAYTONS
S O L I C I T O R S

In difficult economic times the need for bridging the gap between academia and industry, and in supporting early stage businesses, has never been stronger. The challenge of stimulating the creation of university income, by translating new technologies into commercial successes, is the motivation for the Early Stage Companies Group at Laytons.

The Early Stage Companies Group was established by partners with a combination of specialist corporate, intellectual property and commercial experience, who have now worked together for over 12 years. The group advises university and industry spin-outs and other technology start-ups from incorporation to exit. It also acts for VCs and angel investors and was involved in setting up a number of government funds which will pump £270 million of venture capital into

Where Laytons' Early Stage Companies Group stands apart is the length of time the team has worked together handling the issues in the spin-out and early stage context.

UK businesses over the next four years.

Challenges

Creating a successful university spin-out company from a research project is far from easy. It requires the combination of academic brilliance and an astute commercial team, with all the usual support that all businesses need. The sometimes conflicting interests of founders, investors and the university also have to be recognised and carefully balanced. This must all happen within a tight timeframe and a very limited budget.

To attract funding, investors have to be convinced that the opportunities merit their investment. Typically, investors want to ensure that:

- the "right" technology has been selected to be taken forward
- the technology has been validated for commercialisation
- there is sufficient market size and need to justify their investment
- the underlying IP is secure and the spin out has sufficient rights to exploit it
- there is a strong management team to lead the venture

Validation, IP protection, further development work, marketing and attracting the right people to the management team all require funding – or an investment in



Our advice is both highly informed by commercial experience and very good value for money.

kind by those involved – in the first place. A leap of faith (at the very least) is required by the participating individuals.

Advice in context

The most important element of a successful business is the people involved. An experienced management and support team which shares the same vision as the founders is critical to provide the impetus necessary for commercialisation of the technology to become reality.

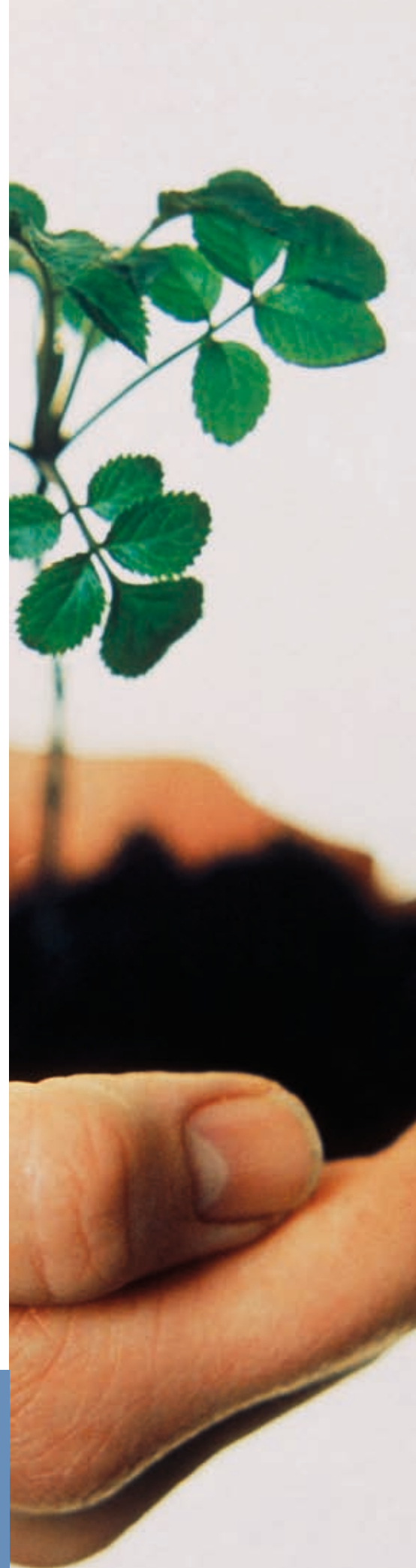
Each of the legal issues involved in the spin-out process should be bread and butter to a commercial law firm. Where Laytons' Early Stage Companies Group stands apart is the length of time the team has worked together handling the combination of these issues in the spin-out and early stage context. This means, for example, that complex tax advice for founders or investors is not given in isolation from the IP or commercial advice that might affect that tax position. The Early Stage Companies Group has many years of combining that expertise to provide a fast, commercially-attuned and pragmatic response for its clients.

This approach and the breadth and depth of experience in the university enterprise activity sector are fundamental to Laytons' success in this field; our advice is both highly informed by commercial experience and very good value for money. Since we make our own investment in selected clients by sharing the risk on fees, it is in our interests to manage costs closely and do everything else we can to assist the long-term success of the business.

Successfully generating income for spin-out companies requires a fair dose of good fortune and funding, but perhaps most importantly a management and support team who can make the best of that combination.

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The Oxford University Lectureship: A Franchise to Innovate?

Professor David Gavaghan depicted the liberating and inspiring aspects of working as a lecturer at Oxford in his presentation to the Oxford Innovation Society in March.

On appointment, University lecturers at Oxford are given the freedom to “engage in research or advanced learning.” None of these terms are defined and it is left to each individual to carve out his or her own path within an environment that could not have been better designed to promote innovation and, indeed, intra-organisational entrepreneurship.

Research environment

To illustrate the freedom I have been given during my Oxford lectureship, I will begin by reflecting on the research environment here. Over the last 15 years, I have been involved in the development of a research group in Computational Biology within the Computing Laboratory. The group now comprises over 60 researchers (University lecturers, research fellows, post-doctoral researchers and D.Phil students).

Research spans the spectrum of theoretical and applied approaches at the interface between computer science and the biomedical sciences. Key application areas include physiological modelling, biological image and signal analysis, and systems biology.

One particularly large Open Source software project, called Chaste, has been developed over the last six years, and has been funded in large part by the Engineering and Physical Sciences Research Council (for more on EPSRC, please see pages 14-15).

This work, which has led to collaborations with leading industrial

partners (including GSK, AZ, Pfizer, IBM, Fujitsu and Microsoft), has been driven by a dedicated group of D.Phil students and post-doctoral researchers using a completely novel approach to academic software development, adapting test-driven, agile approaches borrowed from industry.

This work has placed the group at the forefront of developments across several key application areas in our field, and is allowing us to engage with both regulators (EMA in Europe and the FDA in the US) and industry in an attempt to establish computational techniques as core tools in the drug discovery pipeline.

Graduate education

Innovation at Oxford is also promoted within graduate education. In 2002, working with colleagues from the Departments of Statistics, Physics and Engineering Science, we set up a Doctoral Training Centre aimed at training a new generation of scientists to undertake research at the crossing point between the physical and the biomedical sciences.

The centre was one of the first two to be funded by EPSRC, and has grown steadily over the last decade so that we now have three programmes and an annual intake of around 50 students. The programmes take an innovative approach to graduate education, providing an individually-tailored research programme to each student. This has again been made possible by the nature of the Oxford environment, where strong support



from the University enables the establishment of major initiatives that cut across traditional scientific boundaries.

Our most recent industrial programme is in its second year, and promotes strong links to the biomedical and pharmaceutical industry. The programme is underpinned by an entirely novel Open Innovation agreement that ensures that any arising IP is jointly owned by the University and the thirteen industrial partners in the consortium.

Industry

A more recent project involved setting up a University spin-out company – colwiz – together with a D.Phil student, Tahir Mansoori, who is the founder of the company. The project supports innovations in research and teaching such as those described above through development of a research management, collaboration and productivity platform that supports the concept of “end-to-end research management”.

The platform allows researchers to manage individual and collaborative research from concept through collaborative execution to published results within a single integrated platform, whether that research be in academia, industry, government or bridging across these sectors.

The company has received funding from the University Challenge Seed Fund, and is being strongly supported by Isis Innovation through its Software Incubator

programme. The platform was officially launched on March 7th through a University press release, with a very positive initial response from all sectors.

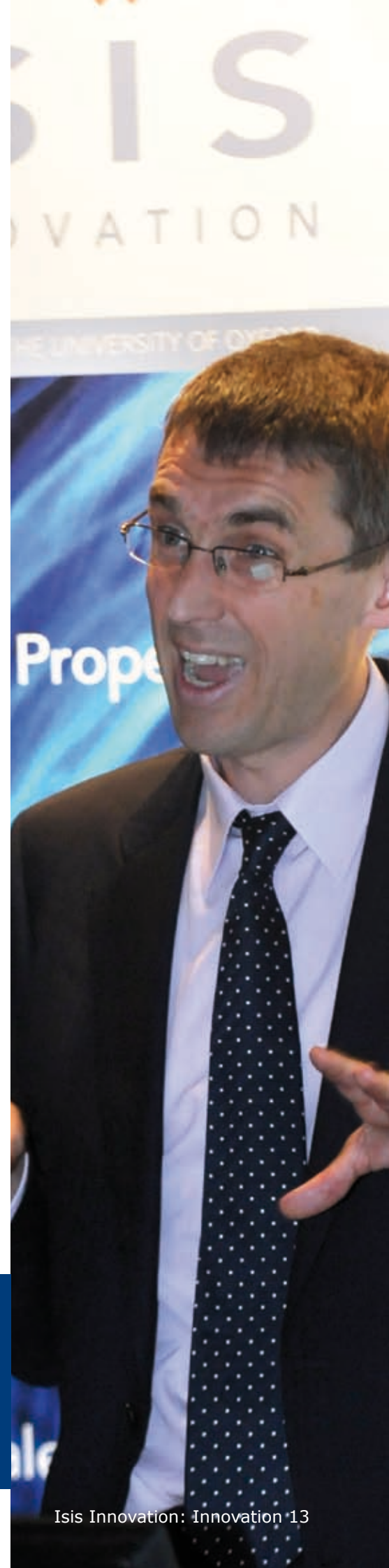
The examples cited allow me to conclude that the Oxford University Lectureship is effectively a “Franchise to Innovate”, with terms of employment that actively promote and foster innovation in teaching, research and entrepreneurship. However, it is the Oxford environment – the international reputation, track record, support services such as Isis Innovation, but above all the people that Oxford can attract to work and visit – that underpins its record for innovation.

Weblinks

www.comlab.ox.ac.uk/research/compbio/
www.comlab.ox.ac.uk/chaste/
www.sabsidc.ox.ac.uk/
www.colwiz.com
www.ox.ac.uk/media/news_stories/2011/110407_1.html

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Business Matters

The Engineering and Physical Sciences Research Council's director of business innovation, **Catherine Coates**, explains why close partnerships with business and academia are crucial in maximising the impact from EPSRC's £850 million portfolio.

EPSRC

Pioneering research and skills

EPSRC is the main UK government agency for funding research and postgraduate training in engineering and the physical sciences. We invest around £850 million a year in world-class research and training, mainly in partnership with the UK's leading universities.

The University of Oxford – one of our 12 key Framework Universities, which account for over 50% of our funding – is high on our list of priority partners. We currently invest in over 300 Oxford projects, to the tune of over £185 million. Many of the research projects we have sponsored in partnership with Oxford academics have led to rapid exploitation via spin-out companies, knowledge transfer and other forms of translation.

A case in point is the work of Professor Sir Mike Brady, Professor of Information Engineering and a non-executive director of Isis, whom we have sponsored for 25 years with funding of over £12 million. Professor Brady's pioneering work

in artificial intelligence, robotics and image analysis, primarily in medicine, has led to numerous start-up companies, including software solutions specialist Mirada, sold in 2003 for \$22 million. Needless to say, we need to make sure the UK taxpayer gets value for money, especially against the backdrop of a real-term decrease of around 15 percent in our funding allocation from government over the next four years.

The bottom line is that we want to see more impact arising from our sponsorship, and are steadily transforming the way we support research and training to ensure this happens. For example, we are focusing more resource on longer-term projects, and training more PhD students in cohort-based doctoral training centres. The reason is simple. We have compelling evidence to show that greater critical mass leads to greater economic and social impact, as well as to better quality PhDs.

Delivering Impact is fundamental to EPSRC, and one of our strategic goals as a long-term investor in UK research and training. A key aim is to encourage more researchers to consider, and include, impact-relevant funding as part of their grant proposals within Pathways to Impact, a cross-Research Council initiative to drive UK research excellence and accelerate its

We are committed to increasing industry-focused training, as well as researchers' mobility between academia and user organisations through Industrial CASE schemes, industrial doctorate centres and other knowledge transfer initiatives.



translation. Doing so will ensure resources are available to fund appropriate impact activities throughout the course of the proposed project.

The other vital ingredient in our transformation agenda is strengthening the partnership between EPSRC, universities and 'users' of the research we sponsor, such as industry, charities and government agencies.

We are committed to increasing industry-focused training, as well as researchers' mobility between academia and user organisations through Industrial CASE schemes (funding for PhD studentships where businesses take the lead in arranging projects with an academic partner of their choice), industrial doctorate centres and other knowledge transfer initiatives.

We now have a portfolio from which 43 percent of our research grants are collaborative with research users. We focus on excellence with impact, and support the ideas-driven research that users need but do not themselves fund.

Through a partnership network of over 2,300 businesses, public sector organisations and charities we are committed to co-defining the landscape of research we support and direct it towards sustainable

long-term challenges. We base our decisions on our core criteria of strategic national need and international research excellence, while focusing on accelerating routes to impact.

At the heart of this partnership is the role of small and medium size businesses, entrepreneurs and venture capitalists, who can take an idea and run with it, or inspire the kind of transformative research which the UK excels at.

Weblinks

Our 2011-2015 Delivery Plan (www.epsrc.ac.uk/plans/approach/deliveryplan/Pages/default.aspx) sets out our priorities and investments over the next four years. For more on collaborative research and partnerships with SMEs (small and medium size enterprises) in co-creating tailored research proposals with academia, and related subjects, visit www.epsrc.ac.uk/funding/grants/business/resources/Pages/strategicpartnerships.aspx

To find out more about opportunities for commercial partners to co-fund PhD projects, and suggest industrial projects for PhD students, see www.epsrc.ac.uk/funding/students/coll/icase/Pages/default.aspx.

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Clean Catalysis

Dr Jamie Ferguson explains how a new technique for producing reactive metal nanoparticles offers a versatile, environmentally friendly manufacturing route.

Producing nanoparticles without polluting

With metal nanoparticles increasingly used as catalysts within chemical, biomedical, optical and electronic fields, there is a need to develop new, efficient and clean ways for their production.

Currently, metal nanoparticles are produced via a variety of methods including attrition (grinding/milling), pyrolysis (formation from vapour phase precursors) and sol-gel techniques (chemical solution deposition).

Whilst each of these techniques has its advantages and disadvantages, there is an increasing demand from researchers and industrial users for new methods to produce reactive metal nanoparticles, in large volumes and under environmentally friendly conditions.

Scientists within the University of Oxford's Department of Materials have developed a new, patent protected technique which creates smaller particles than many other methods, ideal in applications where a large surface to volume ratio is required, without producing pollutants during the process.

Competitive advantages

The particle sizes generated using the Oxford method are tuneable and typically less than 10 nanometres in diameter. The reactivity of the nanoparticles is further enhanced by the fact that they are free from oxide. The synthetic method also

offers the potential for scale-up and use in a continuous process, without the need for solvents and without producing polluting by-products.

The method has been applied to aluminium, copper and gold nanoparticles and could also be applied to a wide range of other metals.

Technology maturity

The method has been demonstrated on multi-gram quantities in a batch process, with consideration also being given to use in a continuous operation. The synthetic parameters which affect the size of the nanoparticles have been understood. Exemplification has been carried out with several metals.

Broad market

High surface area metal nanoparticles offer advantages in a number of applications, including catalysis, aluminium/air batteries and hydrogen production. In catalysis, the small particle size and oxide-free nature of the metal nanoparticles also offers greater reactivity. This is desirable in industrial processes and fuel cells.

Recent work in rocket fuels has seen aluminium/water (ALICE) systems used; in this application smaller particles prove more efficient as there are no opportunities for a passivating hydroxide layer to form, thus making full use of the entire metal payload.

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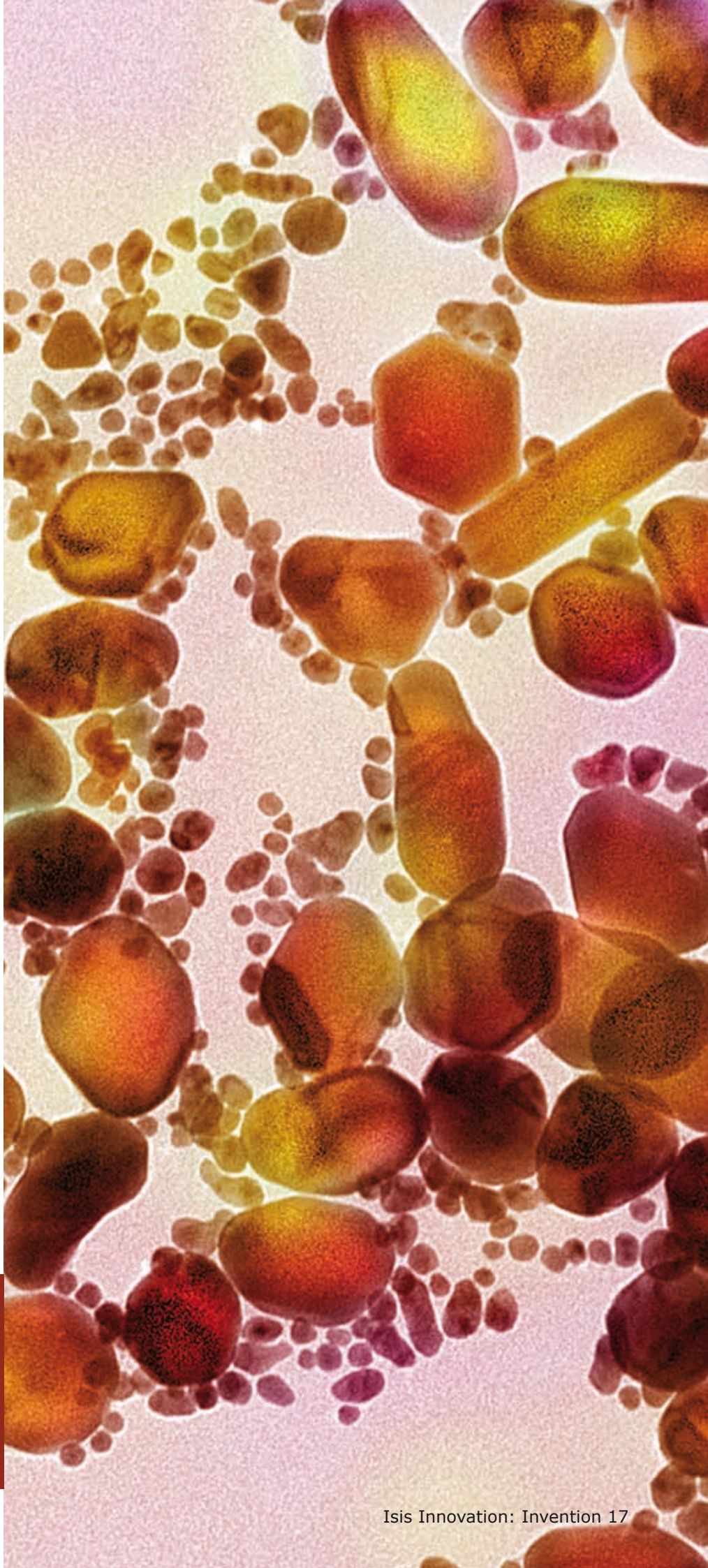
The method has been applied to aluminium, copper and gold nanoparticles and could also be applied to a wide range of other metals.

Patent protection

The underlying technology is the subject of UK patent application GB1014164.6 (priority date 25 August 2010). Companies interested in progressing the commercial opportunity are invited to contact the Isis project manager.

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Measuring Metres down to the Micron – absolutely

Dr Jon Carr explains how a new absolute distance measurement system will offer superior precision and accuracy to a range of users, including car and aircraft manufacturers.

Distance measurement

Many industries, including automotive and aerospace, require measurement of three-dimensional features of large objects.

A recent Frost and Sullivan report stated that revenues from the sale of large scale metrology solutions in the European region alone totalled over £75 million in 2008, with a historical market growth of 14% a year.

Over the last three decades, the laser tracker in particular has been used to make precision measurements of items that are too big to be measured by Coordinate Measuring Machines (CMMs).

Laser trackers can measure three-dimensional coordinates by tracking an infra-red laser beam to a retro-reflective target held in contact with the object of interest.

Traditionally, the laser tracker distance measurement can be performed using a Fixed Frequency

Interferometer (FFI) or an absolute distance meter. The slow FFI is highly accurate, but only measures the target motion, not absolute distance. In contrast, an absolute distance meter can quickly measure distance absolutely – but is typically less accurate.

Researchers at the University of Oxford have now designed a distance measurement system using two tuneable lasers that combines the advantages of both previous methods.

This invention relates to quick, precise and highly time resolved absolute laser distance measurement, using principles of Frequency Scanning Interferometry (FSI). It measures the distance along the line of a laser beam and can do so at repeated rates.

Future developments will enable this system to operate so that successive snapshots overlap in time, allowing displacement of an object to be continuously monitored.

This invention relates to quick, precise and highly time resolved absolute laser distance measurement, using principles of Frequency Scanning Interferometry. It measures the distance along the line of a laser beam and can do so at repeated rates.

Why invest in this technology?

- High absolute accuracy can be achieved, as it can relate distance measurements to an international wavelength standard, giving good traceability.
- Breaking the laser beam requires total resetting of current FFI laser tracker systems; this does not occur with the new invention.
- The invention does not suffer from the disadvantage of previous FSI systems, whereby errors can be introduced when distances change during measurement, for example due to vibration.
- The cost requirements of the tuneable laser are lower than other FSI systems.
- The technique is flexible, and can encompass various measurement ranges or accuracy needs.

This technology will benefit:

- General purpose laser based surveying tools, including laser trackers.
- The accurate determination of the machine tool bed position.
- High accuracy alignment monitoring of large structures: aircraft, ships, telescopes, particle detectors, or formation flying satellites.

Patent protection

This technology is now the subject of two patent applications, and Isis would like to discuss with interested companies the licensing of the technology.



Future developments will enable this system to operate so that successive snapshots overlap in time, allowing displacement of an object to be continuously monitored.

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Respiratory Disease Respite

Dr Alex Marshall explores the potential of Deep Brain Stimulation technology for treating respiratory diseases.

Improved lung function

Oxford researchers have developed a new way of treating the most severe cases of respiratory diseases, such as asthma, obstructive sleep apnoea and chronic obstructive pulmonary disease, for cases where treatment with conventional therapies is insufficient. The team has discovered that electrical stimulation of specific regions of the brain in human subjects can generate significant improvements in lung function.

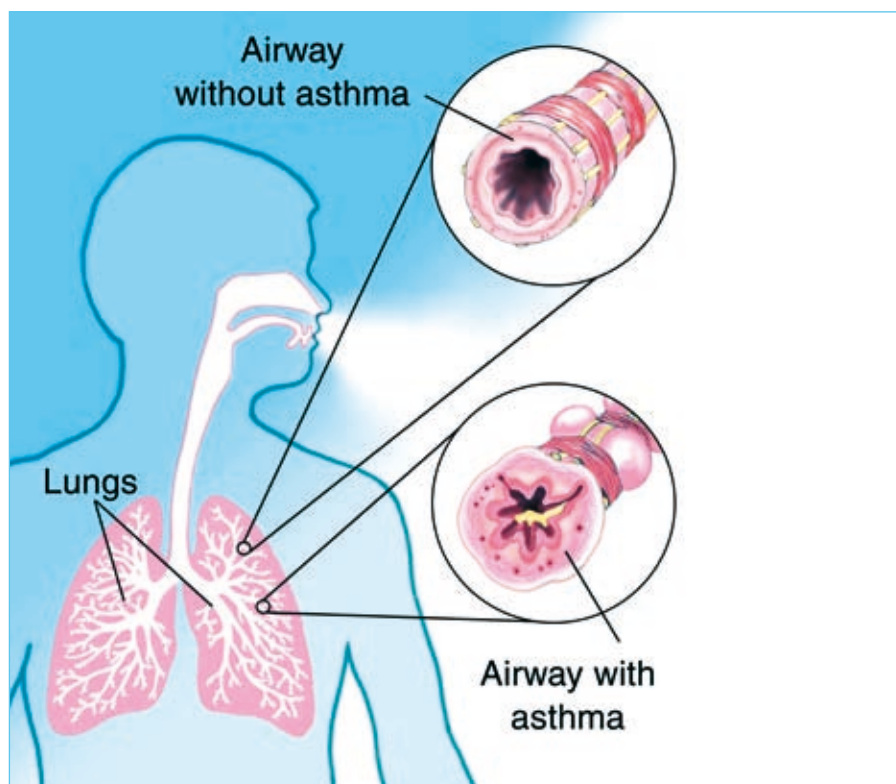
Work to date has shown that a technique known as Deep Brain Stimulation can be used to generate a significant boost to lung function by electrically stimulating specific

brain areas. Data collected to date shows that stimulating the brains of non-asthmatic subjects increases peak expiratory flow rate and basic spirometry (breath measure).

Current work is focused on modelling obstructive airway diseases such as asthma by inducing abnormal respiratory constriction in non-asthmatic patients that have deep brain stimulators fitted – then determining whether stimulation can oppose this constricted state.

Unmet clinical need

Asthma is a chronic inflammatory disease that affects the system of airways that convey air into and



Conditions suitable for Deep Brain Stimulation also include psychiatric disease and epilepsy.

out of the lungs. Once triggered, the resulting inflammation can lead to obstruction to the lung airways and symptoms characterised by a shortness of breath. Symptoms of asthma can occur rapidly and without warning.

Chronic obstructive pulmonary disease, on the other hand, is a progressive reduction in lung function that is particularly associated with the smoking of cigarettes.

Respiratory diseases such as these represent a huge burden to society. There is a stage in advanced chronic obstructive pulmonary disease when breathlessness becomes intractable, leading to repeated hospital admission. Admissions of broadly this type are the second commonest cause of hospital admission in the UK and the USA.

In addition, asthma affects 300 million people worldwide and around 5% of these cannot be treated effectively using current medications such as inhaled corticosteroids and long-acting bronchodilators irrespective of prescribed doses.

There is therefore an urgent need to improve treatment options for patients with severe respiratory disease. For many patients, for whom other therapies have proven ineffective, Deep Brain Stimulation could offer a 'last resort' for what is otherwise a potentially fatal condition. Many deaths from respiratory disease are sudden and result from an under self-administration of bronchodilator therapies. The new Deep Brain Stimulation technique could be constantly active and therefore under-administration of bronchodilator therapy would no longer be a concern.

Established surgical technique

Deep Brain Stimulation is already an established technique for the treatment of Parkinson's disease. The technique involves inserting a small electrode into a specific region of the brain and stimulating that region with low voltage electrical pulses. These electrical pulses are thought to interfere with abnormal signals in the brain that cause tremors in Parkinson's sufferers. Electrical interference prevents the abnormal brain signalling and thereby provides relief from tremors. The operative procedure involves making a 2.7mm hole in the skull and inserting an electrode into the specific region of the brain. The surgery itself generally causes minimal injury to other tissues and patients are normally home within two days following the operation. Indications suitable for Deep Brain Stimulation are growing, and include psychiatric disease, epilepsy and potentially respiratory disease.

Patent status

The technology is the subject of a UK priority patent application. Isis would like to speak with parties interested in commercialising this technology.

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Ecology Map

Brendan Spillane shines the spotlight on user-friendly software from Oxford which predictively maps species and disease distributions.

Remotely sensed data from earth-orbiting satellites provides unique views of our natural world and can be used to illustrate the distribution and abundance of pests and vectors, the incidence and prevalence of diseases, and areas of conservation importance.

The same sorts of environmental data may also be used to show the distribution of subsistence conditions in Africa, according to Professor David Rogers of the Department of Zoology at Oxford. "By understanding the constraints imposed by the local environment on human welfare (through crop production, human and animal health, access to fuel and water etc.) we hope to be able to prioritise interventions and promote appropriate developmental pathways. It is important to maintain a scientific approach to this very emotional subject; climate change may increase the impacts of some diseases, decrease the impacts of others, or have no effects at all."

With this in mind, Professor Rogers and his team developed eRiskMapper: user-friendly software for predictive mapping of species and disease distributions and abundances, with applications in conservation and biodiversity research.

The eRiskMapper tool can be used for making predictions of species distribution and/or abundance from sparse point or administration level data such as field observations and records.

The technique can also make predictions about the likely future

distribution of species (pests, crops, plants etc.) under various climate change scenarios.

The software makes possible the production of risk maps by non-experts including biologists, medics and conservationists. It also allows users to explore their data simultaneously in database, geographical and environmental spaces, thus making clear the linkages between these reference frames. The tool selects a subset from a very large set of potential predictor variables, often derived from satellites, that best discriminates the presence, absence or abundance data classes.

Data analysis

This is the first user-friendly package to use non-linear discriminant analysis for modeling species distribution. Additional functionality allows users to explore their data and the model predictions in full.

Linear discriminant analysis, in contrast, was developed to distinguish three varieties of lilies on the basis of similar measurements taken from each. It assumes similar covariances between the predictor variables. Importantly, non-linear discriminant analysis allows non-similar covariances between clusters of points representing presence and absence sites, thus allowing much greater flexibility in the fitting algorithm.

eRiskMapper itself was first developed in the early 1990s to address the problem of predicting the distribution of tsetse flies in Africa. This was done using linear discriminant analysis techniques.

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These methods were selected because the underpinning assumption of a normal distribution-type response curve (of a species to an environmental variable) has a very firm basis in ecological literature.

Professor Rogers' team has since developed non-linear techniques, a series of methods for selecting the predictor variables and a bootstrapping approach to risk mapping. A new algorithm for risk mapping using polygon rather than just point data has also been developed, along with text files and other outputs to help clarify results. Identifying the importance of each predictor variable has been made possible too.

The Oxford technique may be useful for discriminating any groups defined by continuous or binary coded (dummy) variables, but the potential in the fields of biodiversity research and conservation stands out.

"Like other animals, we humans depend on our natural environment; unlike most other animals we considerably modify this environment, and thus threaten its ability to sustain us into the future," Professor Rogers warns. In this context, the significance of his team's eRiskMapper tool speaks for itself.

Image: Cornflowers, like other cornfield weeds, are becoming much rarer.

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IVF Advances

Dr Bharti Ranavaya discusses how a novel software tool under development at Oxford will facilitate high pregnancy rates for mothers undergoing In Vitro Fertilisation (IVF), via the selection of a single high grade embryo.

IVF is one of the principal methods employed for the treatment of infertility. The success of IVF, resulting in pregnancy, is subject to the decisions made as to which and how many embryo(s) to transfer.

Numerous IVF clinics, in order to maintain high IVF pregnancy rates, transfer more than one embryo per cycle. This is because the likelihood of a successful pregnancy is elevated by the number of embryos transferred into mothers' uteri.

The disadvantages of transferring multiple embryos are the maternal and neonatal (newborn) complications associated with multiple pregnancies/births. For instance, mothers of twins are three times – and mothers of triplets seven times – more likely to experience serious pregnancy-induced complexities.

These include high blood pressure, (preeclampsia), premature placenta separation (placental abruption) and placenta previa (front-lying placenta). The likelihood of premature birth, low birth weight, perinatal death and morbidity (including but not limited to severe neurologic complications) is also greater.

Blastocyst stage

So as to improve transfer rates, most IVF clinics opt to transfer embryos at the blastocyst stage. Human embryos typically reach the blastocyst stage by day five – six after fertilisation. A blastocyst is an embryo that has developed a fluid cavity and two different cell components; a thin outer layer which becomes the placenta and an inner cell mass that develops into the fetus.

Approximately 50% of embryos do not reach blastocyst stage, primarily due to genetic defects. Consequently, IVF transfer of embryos that have reached the blastocyst stage have a greater probability of resulting in a pregnancy.

Embryologists are constantly faced with the conundrum of which, and how many, blastocysts to select for IVF transfer. The latter, in most developed countries, is dictated by legislation.

The challenge of selecting the 'healthiest' embryos is overcome by grading them. Grading entails visual observation and evaluation of the blastocysts, within the growth medium, using a microscope.

Numerous grading methodologies exist and there is no consensus on which to utilise, thus it is impossible to compare data from different laboratories. Furthermore, grading is reliant on the assessment of embryo characteristics by embryologists and thus is subject to human error.

Inevitably variation exists amongst embryologists' grading techniques and their interpretations. There is little quality assurance to account for this variation. To conclude, the selection of embryos at the blastocyst stage of development, for IVF transfer, is inconsistent and qualitative.

Quantitative selection

The ideal for IVF would be single embryo transfer, resulting in a successful pregnancy and birth. Fulfilment of this goal is reliant on the ability to identify the 'fittest' blastocyst. Thus a precise and

The Oxford tool potentially offers greater reliability than existing grading systems.

consistent grading system, which eradicates variability and selects single healthy blastocysts, is required.

Now, a novel tool under development at the Institute of Biomedical Engineering and Nuffield Department of Obstetrics and Gynaecology allows for just such quantitative embryo grading, based on the measurement of embryo features instead of subjective visual evaluation. The Oxford tool, therefore, aids with the selection of a single, high grade (i.e. healthy) embryo for IVF transfer, potentially offering greater reliability than existing grading systems.

Weblink

www.benthamscience.com/open/tobej/articles/V004/170TOBEJ.pdf

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Memory Game

Chim Chu examines a technique for making super-density rewritable optical disks that will help the games and media market keep pace with advances in digital television.

Changing market needs

New digital technologies rely on ever increasing storage capacities and faster transportation of data. Enhanced formats for TV reproduction are constantly being developed and launched, such as 4K HDTV, offering a staggering 4000 pixels in horizontal resolution. Another recent development, 3D HD TV, requires even more data to produce a picture, as the 3D illusion needs two separate pictures to be transmitted for the left and right eye. Similarly, computer games are becoming ever-more graphically realistic. The next generation 3D games will rely on even more data to render their graphics. All of these technologies demand higher density and cheaper media for the corresponding digital content storage and transfer.

An Oxford invention can now substantially increase the information storage capacity for all existing rewritable optical storage disk technologies. The invention involves a technique to dope the disk material, combined with a rapid read/write access technique. The target device applications are existing multilayer DVDs and Blu-Rays (and emerging holographic and 3D optical disks).

Additional information layer

The invention exploits the formation of novel nanostructures in specially doped rapid phase-change memory materials such as $\text{Ge}_2\text{Sb}_2\text{Te}_5$ (GST) to store additional bits of information in the same device volume. An increase of 50 to 100 percent in information storage capacity is possible using this simple information access and storage technique, which has full backwards compatibility with existing technology. Inserting this

invention into industrial processes to manufacture optical disks would require minimal modification to existing plants, and would extend the technology life of these expensive assets.

How the technology works

On the optical disk the information is stored in binary digital form – as a stream of ones and zeros. The ones and zeros are patches of crystalline and amorphous phases that can be interconverted by a laser pulse. These patches have different reflectivities, and this is how the ones and zeros can be distinguished and transformed into the data. The proposed technique utilises novel nanostructures that can be controlled by laser light. The light can amorphise crystalline areas on an optical disk and at the same time induce formation of novel nanostructures in the specially doped layer. These nanostructures can be controlled by the same laser beam. The Oxford technology combines the resultant increase of information density in the doped layer with the reversible and fast read/write times of existing phase-change memory materials.

From fundamental research to commercial applications

This is one of many inventions from the laboratories of the Department of Materials at the University of Oxford. Their leading research into atomic structures of amorphous solids within the Electron Microscopy group, particularly amorphous phases of phase-change memory materials, has revealed novel nanoscale structures in the materials which can be exploited to increase information storage.

An Oxford invention can now substantially increase the information storage capacity for all existing rewritable optical storage disk technologies.

Continuing investment in commercialisation

To protect the invention IP, an international patent application with 29 claims has been filed. A proof of concept translational project is in progress which draws on the capabilities of a number of UK research groups, including the unique facilities of Diamond Light Source near Didcot, Oxfordshire, to identify the parameters for optimal read and write conditions for a prototype. The state of readiness for the market will be considerably enhanced from this technical viability and commercial evaluation stage. Domain know-how will then be available to support commercial exploitation of the invention and derivative IP in collaboration with the industrial partner. The partner will be selected from the leading US and Far East electronics companies currently strong in the information storage area.

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Disk Developments

Applications able to benefit from the Oxford invention include existing and new formats of video reproduction (HD, 4K HD, and 3D HD), long term digital data storage/archiving, video games and software reproduction. The optical media market is estimated to grow at four times the rate of magnetic or solid state media. The entertainment industry is the largest single user of optical media using DVD and Blu-Ray format to deliver its products. The worldwide production of CDs and DVDs exceeds 1 billion units annually.

Data c/o Fastcomcorp.com



Partnership for Preservation

Gurinder Pun, Oxford University Consulting, tells the story of an Oxford student's consultancy project in Mozambique.

Oxford University's postgraduate student Rohitesh Dhawan is helping to develop a project that aims to preserve Mozambique's forests. Rohitesh, an MSc graduate from the Environmental Change Institute, provided consultancy for a UK-based firm that offers consultancy, verification and monitoring services for environmental resources and investments. Rohitesh's participation in the project was arranged by Oxford University Consulting.

The client company is responsible for a project based on the United Nations framework of Reducing Emissions from Deforestation and Degradation (REDD) in Mozambique. One of the first initiatives of its kind to be funded entirely by private capital, it aims to help preserve an area of natural forest that faces pressure from deforestation. It leverages the Voluntary Carbon Market to generate revenues that can be reinvested in the country to provide a viable alternative to the clearing of forests by local communities.

Rohitesh, a specialist in the area of carbon markets, assisted with the development of the Business Plan and the Project Cycle. He

accompanied the project team to Mozambique for meetings with key stakeholders and contributed to the development of the overall strategy. Rohitesh said, "This project is pioneering in many ways and can bring real benefits to the people and environment of Mozambique. It also shows the great potential for partnerships between industry and academia in an increasingly important field."

The project is expected to have a significant impact beyond its immediate scope. It will be implemented through a Public-Private Partnership with the Eduardo Mondlane University, the oldest public university in Mozambique. This model helps deliver on the project developer's commitment to reinvest a significant portion of the proceeds from the project into local communities and the University. In doing so, the project is expected to strengthen local research capacity, establish a new level of accuracy of data related to Mozambique's key environmental indicators and provide valuable input into the government's national REDD strategy.

The project breaks new ground in accelerating the important measures required to prevent deforestation in the continent of Africa. It will be

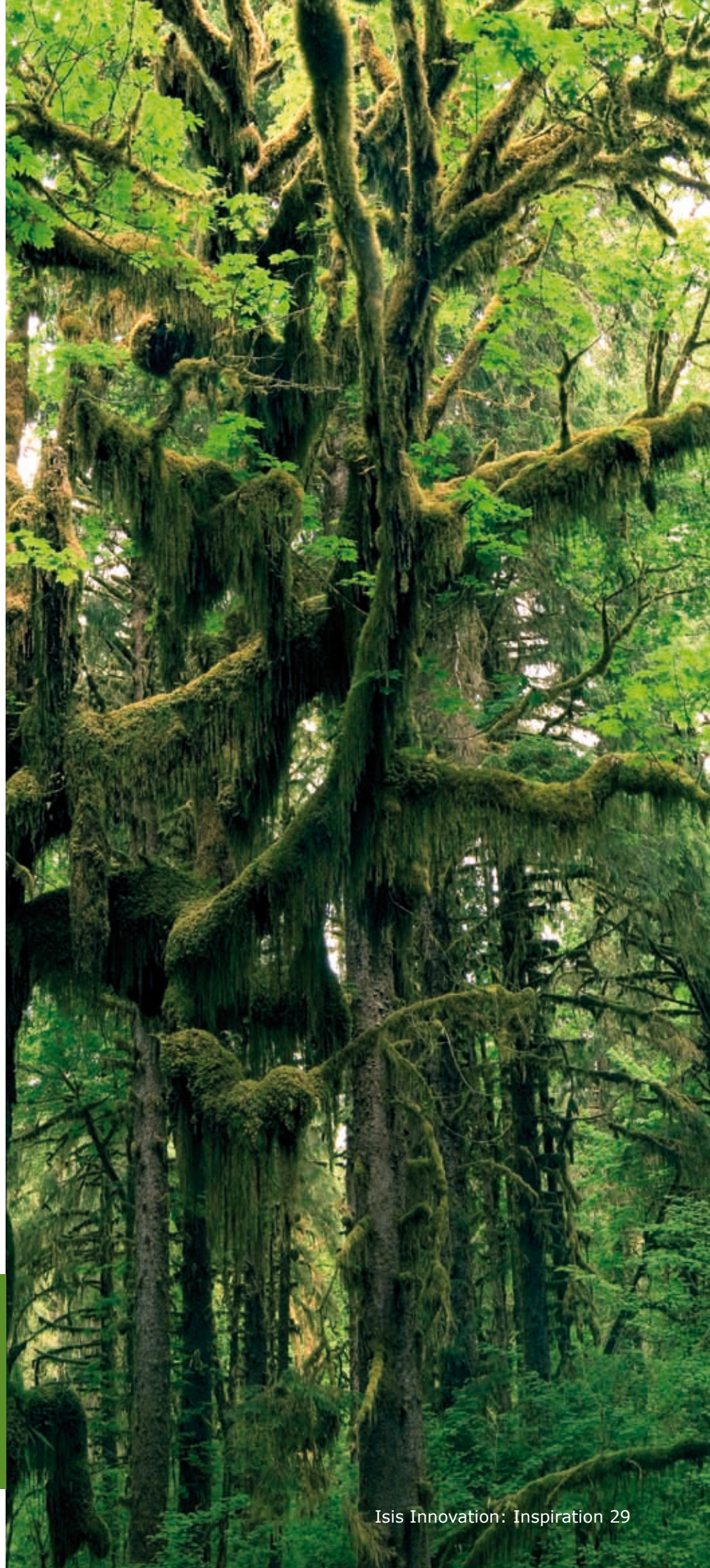
The project breaks new ground in accelerating the important measures required to prevent deforestation in the continent of Africa.

the first project in a programme that can provide a range of benefits to the country. More importantly, it points the way for other African nations to access carbon markets and take early measures to prevent the removal of rainforest resources.

Rohitesh's consultancy is but one of many handled by OUC in the sustainability and environmental arena. OUC's portfolio of projects in this space covers geo-engineering, infrastructure, wind, wave, solar, carbon calculators, biomass, smart metering, electric vehicles and even climate change related video games. The University of Oxford has a wide range of experts who can offer consultancy on strategic high level policy issues or discrete problem solving. OUC facilitates the interaction between this expertise and clients seeking such expertise.

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Global Enterprise

Dr David Baghurst, Head of Isis Enterprise, Asia, reflects on the global reach of Isis Enterprise and the division's technology marketing strategies.

Technology commercialisation is a global activity. Isis Innovation works with technology providers and technology seekers located all over the world, and Isis Enterprise – a division of Isis offering services to non-Oxford clients – has now worked for clients in more than 50 countries. The providers of technologies include universities, small companies and large companies; the 'seekers' include small, medium and large sized businesses.

Technology projects vary in their levels of maturity but include early stage ideas, products and even complete companies. Isis Enterprise's clients include both providers and seekers of technology. However, the client base also features governments, research funders, science parks and investors keen to see innovative ideas adopted by their associated businesses.

Marketing new technology

Isis markets new technologies in numerous ways that broadly fall into two categories: direct and indirect. Direct marketing entails an Isis staff member based in our UK,

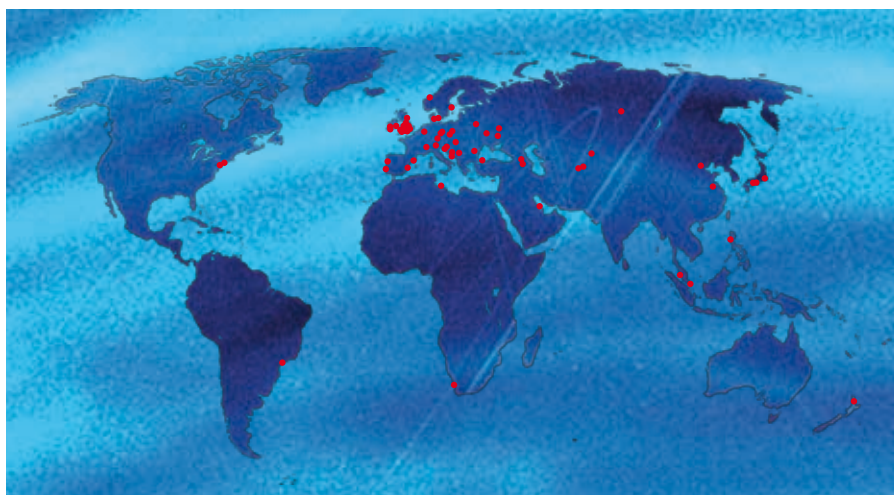
China or Spanish offices analysing and selecting target companies for a professional sales approach. Indirect marketing activities include pushing out information through our website, press releases and technology exchange platforms.

Our electronic newsletters are a great example of our indirect marketing initiatives. We invite technology seekers from around the world to subscribe to receive updates on the new technologies we are marketing from our Oxford and non-Oxford sources. Subscribers are then able to receive promising new innovation launches from our provider partners.

Clean up campaign

One non-Oxford project we are actively marketing involves a new bacterial culture for degrading atrazine and related toxic pesticides. The technology was developed at the Rudjer Boskovic Institute (RBI) in Croatia and is being promoted through their technology transfer company, Rudjer Innovations (RI).

Atrazine is a selective herbicide for broad and narrow leaf weed control, which has been used in 80 countries



A map of Isis Enterprise's international deals.

around the world. In the USA, atrazine is the most widely used herbicide for controlling weed on corn and sugar cane (69% and 90% respectively). Unfortunately, due to its mobility in soil, atrazine is one of the most significant pollutants of surface and ground water, sea water and soil.

Atrazine degradation can be achieved through various chemical methods but these processes themselves involve the use of harmful chemicals or the generation of harmful by-products. Increasing concern about the confirmed toxic properties emphasises the need for new methods to accelerate the degradation processes on atrazine-polluted land.

Scientists at RBI have developed a cheap, easy to apply, environmentally friendly bacterial culture which can be used to clean contaminated land. The technology is protected through a family of patent applications and granted patents filed in key markets including Australia, Canada, China, Europe, India and the US. RI are keen to enter discussions with companies with the capacity to take this technology to market.

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Oxford Innovation Society

Forthcoming meetings of the Oxford Innovation Society will be held on the following dates:

- Thursday 22 September 2011
- Thursday 8 December 2011
- Thursday 22 March 2012

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



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