



UNIVERSITY OF  
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Department of  
Engineering Science

# news

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## Welcome

Welcome to the 2012-13 issue of "Department of Engineering Science News". I am delighted to announce that this year's edition is being sponsored by BP, a British multinational oil and gas company that has operations in over 80 countries (BP was also a London 2012 Olympic Partner!).

Published once a year, this newsletter brings to life the work of the Department to a broad range of audiences covering engineering science news, research, profiles and events.

I hope that you enjoy reading it and welcome your comments on the content. Please feel free to send contributions for next year's "Department of Engineering Science News" to: [newsletter@eng.ox.ac.uk](mailto:newsletter@eng.ox.ac.uk)

Eva Williams  
Editor

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Professor Guy Houlsby  
Head of the Department of Engineering Science

## News this year 2011-12

This year our main focus has been the appointment of new members of staff. In February, Professor Jong Min Kim joined the Department as our new Professor of Electrical Engineering, this is an exciting appointment for us, and you can read more about him on page 9.

During the year we have made an unusually large number of appointments to University Lecturerships. In October we welcomed Dr Jin Chong Tan, from Cambridge, as a University Lecturer and tutorial fellow at Balliol, Dr Ed Walsh from the University of Limerick, and Dr Antoine Jerusalem from Madrid. Four of our own research staff have been promoted to University Lecturerships – Andrea Vedaldi and Michael Osborne in Information Engineering (they will be tutorial fellows at New and Exeter Colleges respectively), and Michael Chappell and Robert Carlisle in Biomedical Engineering. As I write we are filling three further University Lecturerships, including a Tutorial Fellowship at St Peter's College, whom we welcome back as a College admitting engineering undergraduates, after a gap of several years.

Professor Paul Buckley retires this September, and I am particularly grateful to him for stepping in at short notice as Chairman of Faculty during this year. We are also losing Professor Fionn Dunne, who takes up a post at Imperial College, and Professor Ian Reid, returning to Australia to a post at Adelaide University – both have played vital roles here recently, Fionn as Deputy Head of Department and Ian as Director of Graduate Studies. Also returning to Australia is Dr Alex Lubansky, who has enthusiastically contributed to Chemical Engineering as a Departmental Lecturer.

Last autumn David Miller, our Senior Administrator, was tempted back into the commercial world of large project management. Fortunately we have now refilled his post (retitled as Head of Finance and Administration), and Dr Joanna Rhodes has just joined the Department. She is a Maths graduate from Oxford, so should have no trouble with the complexities of our financial planning!

**Professor Guy Houlsby**



## Student Achievements



### IET Awards

The Institution of Engineering and Technology (IET), recently held its annual Ambition and Achievement Awards ceremony in London. The ceremony was hosted by Liz Bonnin (pictured above), television presenter on BBC's 'Bang Goes the Theory' programme. Amongst the 30 prize winners was Philip Sibson, from the Department of Engineering Science, who received an Undergraduate Belling Scholarship worth £3,000.

### RAE Awards

Two of the Department's undergraduates, James Dolan and Philip Sibson (pictured above), received the Royal Academy of Engineering's (RAE) "Engineering Leadership Advanced Awards", worth £5,000 each. "Engineering Leadership Advanced Awards" provide support and motivation to some of the most exceptional engineering undergraduates in UK universities. They are highly prestigious and the Academy awards no more than 30 in any one year.



### SET Awards

One winner and two finalists from the Department of Engineering Science were announced at the 2011 Science, Engineering and Technology (SET) awards ceremony, in Grosvenor Square, London. The SET Awards are Europe's most important Science, Engineering and Technology awards for undergraduates. Mark Baker was the winner of 'The Airbus Award for the Best Aeronautical Engineering Student'.



### NCE Graduate Awards

Henry Taylor, who graduated from the Department of Engineering Science with a First Class degree (Somerville College, Oxford 2009) and currently working as a Graduate Geotechnical Engineer for Arup, recently received a "highly commended" prize at the prestigious New Civil Engineer (NCE) magazine's Annual Graduate Awards ceremony in London. It was Henry's design work on the foundations of a prestigious national museum building in Doha, for the Qatar Government, that caught the eye of the all-engineering judging panel.



# The Power of Engineering and Management

'Maurice Lubbock strongly believed in two ideas: that engineering was the mainspring of the British economy, and that with better management, British industry could lead the world'. Set up in his memory in 1957, the Maurice Lubbock Memorial Fund continues to support engineering and management at the University of Oxford today.

The Hon. Maurice Lubbock, who had been an undergraduate at Balliol College in the 1920s, served on the Board of Lloyds Bank, Rolls-Royce, London Assurance and Australian Mercantile, but it was his Chairmanship of Production-Engineering (P-E) in 1934, that gave the impetus to the creation of the Maurice Lubbock Memorial Fund. The Fund was founded by his son, Eric, who recalls: *"He was a passionate believer in the power of engineering and management to improve the human condition, and we have funded engineering scholarships and fellowships at Balliol in his name. We have also assisted the Department of Engineering Science and the Saïd Business School, to hold lectures in memory of Maurice Lubbock"*.

## The Maurice Lubbock Memorial Lectures

This year's Maurice Lubbock Memorial Lecture, titled: "London 2012 – Engineering Success," provided a fascinating insight into the construction of the multi-billion pound London 2012 Olympic and Paralympic Park. It was given by Howard Shiplee CBE, who was the Olympic Delivery Authority (ODA) Director of Construction and the man behind Britain's largest ever sports project. Today, Howard Shiplee is an Executive Director with Laing O'Rourke, an internationally-focused engineering enterprise, responsible for some of the world's most iconic buildings.



Pictured from left to right are: Professor Guy Houlby (Head of the Department of Engineering Science); Lord Avebury (Chairman of the Lubbock Trust); Mr Howard Shiplee CBE (Executive Director with Laing O'Rourke).

*Howard Shiplee's Lubbock Lecture highlighted the enormous responsibility for controlling costs, design and the actual legacy of the site for London and the UK. He said: "We are now a beacon of hope and continuing success, demonstrating on a world stage what our industry can do, and importantly keeping alive and keeping secure a huge amount of technical, managerial and organisational expertise that resides in the industry across all our disciplines. For me this is a showcase for UK plc on the world stage".*

Over 150 attended this year's Lecture, including academics, alumni, students and representatives from industry and government, as well as a number of pupils and teachers from schools in Oxfordshire.

The first Lubbock lecture was given by Sir Harold Hartley in 1964 on "the Contribution of Engineering to the British Economy". Since then the Lubbock lecture series has included a wide range of engineering topics. For example, "Sustainable energy – without the hot air" by Professor David Mackay FRS, Chief Scientific Advisor to HM Government on Energy and Climate Change; "Engineering – Science or Art" by Sir Francis Tombs; "Google – 1 billion searches a day and counting" by Professor Thomas Hofmann, Director of Engineering Google Zurich.

The Maurice Lubbock Memorial Fund maintains its commitment today by supporting lectures, scholars, a Fellowship in Engineering, a College Lectureship in Management, seed corn funding for small projects, "one-off" grants and student prizes.

Our thanks to the Trustees of the Maurice Lubbock Memorial Fund: Lord Avebury (Chair); Sir John Lucas-Tooth; Professor Sir Drummond Bone (Master of Balliol College); Dr. Alastair Howatson; The Hon. Lyulph Lubbock; Dr Mike Jones (Director of the Foundation for Management Education).



**Maurice Lubbock's son, Eric, who succeeded to the title of Lord Avebury in 1971, is the current Chairman of the Lubbock Trustees. Fifty years ago Eric Lubbock won the Orpington by-election of 1962 - still regarded as one of the biggest by-election upsets in British political history. In 1976 he founded the parliamentary human rights group which he chaired for 21 years.**

Here he tells his story:

"I entered Balliol in 1945, read Maths moderations for two years, then engineering. I boxed for the University (bantam, then featherweight) and was rusticated the summer term before my finals, which I spent at Saunders-Roe (British aero and marine engineering company) on the Isle of Wight, where the Princess flying boat was built.

After graduation I did two years' National Service in the Welsh Guards, including 18 months with the occupation forces in Germany as a 2nd Lieutenant. Unfortunately we were forbidden to fraternise so I only picked up a few words in German.

In 1951 I joined Rolls-Royce Derby as a graduate apprentice, after which I was a technical assistant to the Foundry Manager, working on the first air-cooled nozzle guide vanes for the Conway engine used in the V-bombers.

In 1955 I moved to Production Engineering Ltd management consultants, working for a variety of clients on manufacturing methods including Raleigh Industries the bicycle manufacturers. In 1960 I moved with my wife and three children to live at my mother's in Orpington, taking up a job with Charterhouse in the City to work as a nominee director on some of their engineering subsidiaries.

Two years later I was catapulted unexpectedly into national politics when I won the Orpington by-election, and in 1964 I was appointed Chief Whip of the Liberals in the Commons, a position I held until I lost Orpington at the general election of 1970. I also spoke for the Party on science and technology during the eight years I spent in the Commons.

In 1971 I inherited the Avebury peerage and have sat in the Lords for the last 42 years, though I have always opposed the principle of hereditary peerages.

I now speak on a variety of subjects including foreign affairs, immigration and asylum, and human rights, and on my 80th birthday I vowed never to retire. Of course, I will be happy if the process of Lords Reform makes me redundant!"

# Enterprise and Innovation

In the last year Professor Yiannis Ventikos co-founded Oxyntix, attracting investment of £1m for a company created to develop and validate a proposed new method of achieving extreme intensity bubble collapse with potential applications in nuclear fusion power generation and sonochemistry, among others.

The Department of Engineering Science has wide experience of commercialising its discoveries. Oxford Instruments, spun-out of the Clarendon Laboratory in 1959, is generally accepted to be the first Oxford spin-out of modern times.

In 1987 the company that became Isis Innovation was established as the University's Technology Transfer Office, assisting researchers who wish to commercialise the results of their research.

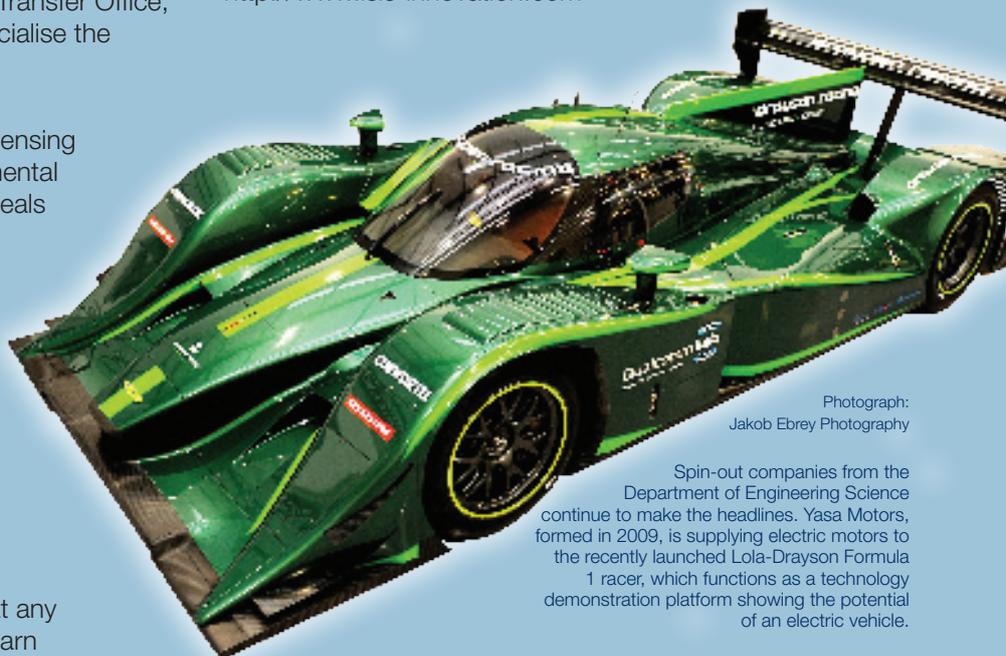
## Licensing IP

On a day-to-day basis Isis is focused on licensing IP and facilitating consultancy and departmental services. In the last year 113 new licence deals and 243 consultancy opportunities were handled by Isis for the University.

The headline-grabbing activity, however, remains the formation of spin-out companies. High profile spin-outs of previous years include Mirada Medical (software and analytical tools for medical imaging) and Oxford Yasa Motors (lightweight electric motors), both now well established and recognised leaders in their respective fields.

Isis welcomes enquiries from researchers at any stage, and offers regular opportunities to learn

about patent protection and commercialisation. Alumni with an interest in supporting departmental research can contact Isis to find out more about opportunities for investment in spin-out companies, CEO opportunities for experienced managers, or supporting University research through donations to the Oxford Innovation Fund: <http://www.isis-innovation.com>



Photograph: Jakob Ebrej Photography

Spin-out companies from the Department of Engineering Science continue to make the headlines. Yasa Motors, formed in 2009, is supplying electric motors to the recently launched Lola-Drayson Formula 1 racer, which functions as a technology demonstration platform showing the potential of an electric vehicle.

## Students design for CERN's Large Hadron Collider

The hadron beam at CERN's Large Hadron Collider (LHC) is held in vacuum, and a structural vacuum chamber is needed around the entire 27 kilometre ring. It is paramount that, at the beam collision points, the chambers to be designed are transparent to particles created during a collision, so that the products can be detected, unimpeded, by the LHC experiments.

Engineering Science students in their 3rd Year were invited to the CERN laboratory in Geneva to present their ideas for new vacuum chamber designs for the experiments of the Large Hadron Collider.

### Design objectives

Their design objectives were to propose alternatives to beryllium – the material used for some of the existing experimental vacuum chambers. Beryllium (chemical element with the symbol Be and atomic number 4) is toxic, expensive, difficult to machine and join,

and can have associated health problems if personnel were exposed to the element in a particle form caused by damage to a chamber.

Teams of students developed theoretical designs from intensive research based on their special knowledge acquired on their course coupled with other resources. Their research resulted in learning about carbon fibre-reinforced carbon (aka carbon-carbon), which has been used for the leading edges of the (now retired) Space Shuttle orbiter, and more recently in the braking systems of Formula One racing cars. It is a composite material consisting of carbon fibre reinforcement in a matrix of graphite.

*"We have all found it exciting to do a live research project – many 3rd Year students don't have an opportunity to visit a prominent research facility like CERN".*

Constance Mantle



Example of carbon-carbon: the brake disc of this Ferrari race car's braking system is made from carbon-carbon.



# Imagine ○○○

○ You are on a city break in Oxford and pass a building with a dramatic sculpture in its courtyard. You want to find out what it is.

**How do you do it?**

○ You want to find a picture of your son swimming from 100,000 images on your mobile phone. **How could you find it?**

○ You see a flower on your walk, whilst on holiday in the Lake District, and you want to find out what it is. **How do you do that?**



Sheldonian Theatre, Oxford

## Making everything visual searchable

These, and many other visual identification and retrieval tasks, are problems that the Oxford Visual Geometry Group has developed algorithms to solve. The aim is to enable visual data - images and videos - to be searched with the ease, speed, and accuracy of a Google search of the web. The 'query' can be an image of the object - for example of a flower or sculpture that you would like to identify - or a textual description, e.g. "Eiffel Tower", as with a Google search.



Andrew Zisserman, who leads the Visual Geometry Group, says "Our goal is to make everything visual searchable". Together with his students and collaborators, Relja Arandjelovic, Yuning Chai, James Philbin, Josef Sivic and Andrea Vedaldi, they have built search engines for queries including people, facial expressions, human poses, human actions, sculptures, paintings, buildings, flowers, Greek vases and more.

## Engineering visual data

As with any large scale information retrieval system, and Google web search is an example, the key to immediate retrieval is to compute as much as possible in advance, so that the actual search for the query incurs little computational cost. In the case of visual search the research questions are how to engineer visual descriptions that can cope with the problems specific to the visual domain - change of scale, change of viewpoint, change of lighting, within class variation (searching on text does not have to deal with these challenges); and how to learn such descriptions from vast quantities of visual data.

The visual geometry team is part of the Department's Information, Control and Vision Engineering Research Group.

You are invited to visit on-line web demos:  
<http://www.robots.ox.ac.uk/~vgg/demo/>



## Facebook for animals

How animals associate in groups can have important consequences in terms of the health and survival of both individuals and whole populations, and can influence factors such as the spread of disease and the ability to find food or mates.

But revealing the networks underlying animal societies is a challenge when a large amount of fieldwork data consists of a long stream of automated observations of the times and locations of individuals.

A new way of analysing the social networks that link individual animals to each other has been tested on wild great tits by an Oxford University research team, supported by Microsoft Research.

The tiny data logger fitted to this great tit's leg is one of thousands that the research team (comprising: Ioannis Psorakis, Stephen Roberts and lead Rezek from the Department of Engineering Science and Ben Sheldon of the Department of Zoology) is using to study "social networks" in birds. The new approach can automatically identify periods of intense social activity within a large number of observations - in this example around one million observations of wild great tits (*Parus major*).

"If you think of the data about you in Facebook it records things like who you are friends with, where you've been, and what you share with others," said Ioannis Psorakis. He added "What we have shown is that we can analyse data about individual animals, in this case great tits, to construct a "Facebook for animals" revealing who affiliates with who, who are members of the same group, and which birds are regularly going to the same gatherings or events".

Some of the most important future steps in this work are to combine the 'social' information available through this method, with other types of information: for example combining it with genetic data is enabling researchers to explore the genetic basis of sociality: do genetically similar individuals attract each other, or is it the other way round? Can we find specific areas of the genome that account for gregariousness?

The work could also help researchers understand how information spreads through animal populations.

# Global exchange of ideas



## The 2012 Medtronic Lecture

Standing left to right: Professor Lionel Tarassenko CBE (Director of the Institute of Biomedical Engineering); Professor Brian Bellhouse; Eleonora Mylonopoulou (2007 Medtronic Scholar); Professor Constantin Coussios; Professor Alison Noble; Professor Zhanfeng Cui; Professor Molly Shoichet (Guest Lecturer); Dr David Dunham (Medtronic); Mr Steve Mahle (Retired Chair, Medtronic Foundation); Professor Andrew Carr (Nuffield Department of Orthopaedics); Ioanna Zafeiri (2010 Medtronic Scholar).

Since 2008 Medtronic, the global leader in medical technology, has supported education and research in biomedical engineering across the Atlantic. Medtronic graduate scholarships at the Department's Institute of Biomedical Engineering (IBME), with a special focus on promoting women, as well as the Oxford Medtronic Lectureship, have played a key part in encouraging the exchange of ideas within the field of biomedical engineering between universities in the United States and Europe.

Hundreds of academics, students and representatives from industry and government have attended the Oxford Medtronic lectures. Audiences have not only learnt about advances in medical technology that are helping to advance the treatment of diseases but have also been shown the value of 'joined-up thinking' as biomedical engineers work in close collaboration with hospital doctors.

Dr David Dunham, Medtronic's Regulatory Affairs and Quality Manager for UK & Ireland, said: "...we have a wonderful culture, which is mission-driven. It's about alleviating pain, restoring health and extending life. This is one of the reasons why we're developing new technologies in the med-tech area and this lectureship is an integral part of that".

## Leaders in biomedical engineering

The Department's Oxford Medtronic lectures have been given by some of the world's most eminent academics in the field of biomedical engineering – they were:

- In 2008 – Professor Shu Chien, the Director of the Institute of Engineering in Medicine at University of California, San Diego.
- In 2009 – Professor Roger Mark, Distinguished Professor in the Harvard-MIT Division of Health Sciences and Technology.
- In 2010 – Professor Mark Prausnitz, Professor of Chemical and Biomedical Engineering and Director of the Centre for Drug Design, Development and Delivery at the Georgia Institute of Technology.
- In 2011 – Professor James Duncan, Ebenezer K. Hunt Professor of Biomedical Engineering and Professor of Diagnostic Radiology and Electrical Engineering at Yale University.
- In 2012 – Professor Molly Shoichet, Professor of Chemical Engineering and Applied Chemistry and Canada Research Chair in Tissue Engineering at the University of Toronto.

## The vital role of Medtronic graduate scholarships

Graduate scholarships - funded by the Medtronic Foundation - have played a vital role in promoting women in engineering science. The following Medtronic scholars have benefitted enormously:

**Eleonora Mylonopoulou** – Eleonora recently finished her PhD in Oxford. Her work was on targeted drug release from thermosensitive liposomes with therapeutic ultrasound, for the treatment of liver cancer. Currently she is working as a researcher in the University of Oxford, on imaging tumour response to therapy. She is also involved in the design and execution of clinical trials of the combination of therapeutic ultrasound with liposomes for metastatic liver cancer.



**Ioanna Zafeiri** - after completing her MSc in Oxford, Ioanna returned to Greece to work for a start-up healthcare company based in Athens. Ioanna's role involved providing scientific support to the consumer health care and the medical equipment and device units of the company. Today, Ioanna is in Birmingham (UK) studying for an Engineering Doctorate in Formulation Engineering.



**Stéphanie Trine** - joined Merck Serono two and a half years ago after an initial internship with BioAlps in Geneva. She joined their Technical Operations Graduate Training Scheme which included 'continuous improvement on a biotech production site in Switzerland' and the 'customisation of injection devices' based in Switzerland. Since then she has joined their Operational Excellence unit.



**Berenika Luczak** - has moved to New York, USA, where she is working as a management consultant focusing on life sciences. Berenika's work allows her to help pharmaceutical, medical device and biotechnology organisations implement the best business models to deal with today's ever-changing world, and ultimately deliver the highest quality healthcare to patients.



**Lauriane Sermet** - completed her Masters in Mathematics in France. She is in France attending pre-med lectures as well as working at the Lyon Neuroscience Research Centre, on brain computer interfaces. Lauriane said: "I hope to get into Medical School next year and I would love to be able to combine biomedical research with clinical practice in the future".



# The choices women and men face

For the first time the Department of Engineering Science is applying for Athena SWAN silver status.

The Athena SWAN Charter is a scheme, funded by Equality Challenge Unit, the Royal Society, Biochemical Society and the Department of Health, which recognises excellence in STEMM employment in higher education. Any university or research institution which is committed to the advancement and promotion of the careers of women in Science, Technology, Engineering, Maths and Medicine (STEMM) in higher education and research can apply.

One of the beliefs underpinning the Charter is that ‘science cannot reach its full potential unless it can benefit from the talents of the whole population, and until women and men can benefit equally from the opportunities it affords’.

Dr Penny Probert Smith, who is leading the Department’s application for Athena SWAN silver status, recounts her own story in higher education: “Since doing my first degree in Cambridge in the 1970s, where I was one of five females in a year of 340, life has changed for women (for example women now constitute around 22% of engineering students at both Oxford and Cambridge Universities) but particular issues still arise.

I arrived in Oxford as a University Lecturer in 1988 with three small children, and had my fourth in 1989 (not ideal timing!). At this stage there was only one other woman faculty member. Now, driven largely by the Department’s involvement in Biomedical Engineering, there are six, of whom three have young children.

I work in the Department’s Institute of Biomedical Engineering on image formation from the brain (MEG) and from microwave systems to detect breast tumours. It’s an exciting and fast moving area but I’ve always valued too the undergraduate contact and support offered by college life - I’m currently Vice Principal in my college, Lady Margaret Hall.

Paul Jackson, Chief Executive of EngineeringUK, said: “Britain’s economy needs a strong foundation for growth. An estimated 2.2 million additional engineers will be needed over the next decade if our successful manufacturing and engineering activities are to thrive. This is a sector that generates £1.15 trillion turnover and employs 5.6 million people — 19 per cent of the work force. However, only 10 per cent of applications to university engineering courses are from women and the numbers for apprenticeships and the wider further education system are in the low single digits.... When four of the top 10 degrees by salary on graduation are in engineering, why should we be excluding 50 per cent of the population?”

**Extract from “The Engineer” magazine, July 2012**



The flexibility in university life is enormously sympathetic to sustaining family life; but underlying it is a long-hours culture and a globally competitive research environment. I resigned an early academic position in Cambridge to spend time with my children but this was a high risk procedure. Although extended periods of maternity leave are now common it is particularly hard to build the high individual research profile needed for a successful career with significant breaks and on-going family responsibilities. Nor does family life end when children reach 18; many still need support. And it’s great to welcome the next generation: my first grandchild was born in June 2012, and I have two, young step grandchildren.

There is no obvious solution. Child care provision has been transformed – but dual career couples often have to favour one career over another. Work-life balance is no easier in academia than elsewhere. Perhaps the most useful outcome of the Athena SWAN proposal will be to improve support structures to help men and women not to solve all the problems but to negotiate their way through them, through informed choices and a better understanding of where those choices lead”.



“ There is no obvious solution. Child care provision has been transformed – but dual career couples often have to favour one career over another”.



# Headstart for Sixth Formers

Following the announcement of a new construction engineering partnership, between Laing O'Rourke and the University of Oxford, last year, the Department of Engineering Science is delighted to report on Laing O'Rourke's vital support for Headstart. Headstart, part of the Engineering Development Trust, has been established for more than 16 years as a charitable trust providing hands-on Science, Technology, Engineering and Maths (STEM) activities and engineering taster courses to encourage young people into technology-based careers. It is run under the auspices of the Royal Academy of Engineering.

This year the Department's Headstart programme included practical problem-solving activities, team projects, industrial site visits, lectures and tours of laboratories - including a gala dinner at Hertford College.

Over 2,500 sixth form students applied nationally to Headstart in 2012, with 37 attending the Department's course in Oxford. Students came from a variety of schools; including maintained non-selective, maintained selective, independent, further education and sixth form colleges, and academies.



Research by Headstart (not by Oxford) shows that the scheme is very important in helping students decide on their course of study and over 60% tracked through university are reading engineering degree courses. Approximately 86% of participants declare engineering or science-based roles as their first job destination.

## What the Sixth Formers thought

After his Headstart experience, Jake, from Bishop Wordsworth's School in Salisbury, said: "Engineering initially caught my eye as the idea of tackling real-life practical problems really appeals to me. The Headstart practical lab sessions were the most exciting part of the course for me. They gave a real insight into what studying engineering is like and offered an experience you can't get in schools".



Freddie, who came on this year's course from Prior Park College in Bath, added: "I enjoy taking on a challenge and working through it scientifically, and the end result is always very satisfying. My favourite part of the course was

programming a robot to follow a line on the floor. We had to think of solutions for when it got lost or hit an obstacle, and then input the code. There were a number of solutions and working through them was really fun. I wasn't expecting to have as much fun as I did, but the course has shown me how enjoyable working with a group of enthusiastic engineers can be! I am looking forward to university a lot".

## Student engagement

Mr Tony Brown, Design Leader with Laing O'Rourke, who supervised one of the Headstart site visits, commented: "At Laing O'Rourke we are always striving for engineering excellence in all our works, and are delighted to be able to support the Engineering Science Department on the Headstart programme. It was a pleasure to show them around our projects on the Radcliffe Observatory Quarter site in Oxford. We were impressed with their attitude and engagement".



Photograph: David Hartley

Our special thanks to Laing O'Rourke, Headstart, Sharp Laboratories of Europe, Culham Science Centre, and Hertford College, as well as to all volunteers, technicians and academics from the Department of Engineering Science.



## Inaugural lecture

In 2012 the Vice-Chancellor, Professor Andrew Hamilton, presided at Professor Constantin-C Coussios' inaugural lecture.

The lecture, titled: "**Engineering non-invasive therapy and drug delivery**", was attended by over 150 people. In the audience were family and friends, past and present colleagues, students, decision makers from government, academia and industry, and members of the public.

Professor Coussios (pictured above) eloquently communicated how ultrasound is rapidly emerging as a most promising tool for non-invasive therapy and drug delivery. He demonstrated new approaches to medical treatments and provided a fascinating insight into the potential technological and clinical benefits of his group's research, namely:

- The use of ultrasound-based passive mapping techniques for improved real-time, low-cost treatment monitoring during non-invasive ablation of deep-seated tumours by high intensity focused ultrasound.

- The exploitation of localised mechanical and thermal effects mediated by therapeutic ultrasound for targeted release and improved delivery of anti-cancer drugs.
- The tremendous potential of combining therapeutic ultrasound and microbubbles with a novel replicating oncolytic adenovirus to achieve highly selective tumour-specific self-amplifying therapy that leads to significantly improved survival.

**Professor Coussios** founded and heads the Biomedical Ultrasonics, Biotherapy and Biopharmaceuticals Laboratory (BUBBL) within the Department of Engineering Science at the Oxford Institute of Biomedical Engineering. He has been the recipient of the 2012 Bruce Lindsay Award by the Acoustical Society of America and of the Frederic Lizzi Award by the International Society of Therapeutic Ultrasound.



# Samsung nanotechnology expert comes to Oxford

Jong Min Kim, one of the leading figures behind Samsung's nanotechnology research - such as the world's first full colour television screen using carbon nanotubes, quantum dots and 'smell-o-vision' (smells to accompany television images to create 4D - the next step from 3D and HD) - has been appointed Professor of Electrical Engineering at Oxford University's Department of Engineering Science.

During his time as Senior Vice-President with the Samsung Advanced Institute of Technology Jong Min helped to transform the world of electrical gadgets. His research has played a significant part in Samsung's success today - its flagship company, Samsung Electronics, leads the global market in high-tech electronics manufacturing and digital media, and is the world's largest maker of computer memory chips and flat screen displays.

## Change of career path

Born in the mid-1950s three years after the Korean War, which had left its population demoralised and its infrastructure destroyed, Jong Min grew up in Chungdo, the southern part of South Korea. Here he dreamt of becoming a medical doctor and helping those in need in Asia. That changed when he won a special scholarship (all fees and expenses paid) to study for an Electronics Engineering degree at South Korea's Hongik University.

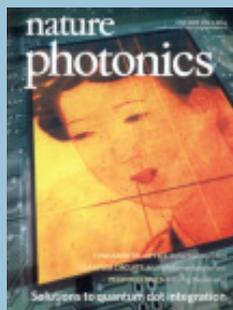
Jong Min went on to gain two more scholarships to study electrical engineering in the USA and acquired an aptitude for this subject that has kept him at the cutting edge of research in the electronics industry.

## International reputation

Having held a variety of senior technology positions at the Samsung Advanced Institute of Technology including Director of Frontier Research, Jong Min's research is described in more than 250 major journals including "Nature", "Science", "Nature Photonics" and "Technology Review". He has given 90 keynote, plenary and invited speeches, made 250 presentations at international conferences, and been responsible for 250 intellectual property disclosures (more than 150 of them registered in USA).

His name is synonymous with a number of world firsts in carbon nano-materials including papers on carbon nanotube field emission high definition televisions, transparent and flexible graphene electrodes, and quantum dot based LEDs and displays.

Jong Min Kim has been recognised by both Samsung and the Republic of Korea Government - winning the Samsung Group Outstanding Technology Gold Award and the Republic of Korea Government Awards for Special Achievement and the Korea Science & Technology Award. He was also nominated as the first Samsung Fellow out of 80,000 R&D staff - there are only 10 Samsung Fellows in the Samsung Group.



## The wonders of quantum dot photonics

With a flair for imaginative thinking and a first-class team of researchers Jong Min Kim remembers his most recent study with Samsung: "We converted a scientific challenge into a real technological achievement ... quantum dot displays".

Professor Kim explained: "Quantum dot (a form of semiconductor) display screens promise high resolution images, higher energy efficiency and will be cheaper to manufacture. My team of researchers succeeded in making a 4" prototype on glass as well as on flexible plastic. This research could lead to the development of bendable and flexible displays and lighting for the next generation of televisions, mobile phones, digital cameras and portable game systems. Previous attempts to make full colour dot displays have faced challenges in that image quality tended to decrease with the size of the display screen. I hope to see quantum dot photonics commercialised in the near future".



## Future Challenges

At the Department of Engineering Science, Professor Jong Min Kim will be employing both his business skills and electronics research expertise to develop collaborations with other Oxford University departments, international universities, governments and companies in the UK, South Korea and Europe.

The impact of this research could mean creating nano assisted living with new electronics for us all - weighing the same as a single sheet of A4 size paper imagine a flexible television that people can roll up like a newspaper, carry in their pockets and view wherever they are ... watch this space!



Professor Jong Min Kim, together with Professor Guy Houlisby, Head of the Department of Engineering Science, recently hosted a special visit by Dr Chang-Gyu Hwang who is the National Chief Technology Officer and Head of the Office of Strategic R & D Planning in the Ministry of Knowledge Economy with the Government of the Republic of Korea. Dr Hwang was previously President and CEO of Samsung Electronics.

# Beyond stereotypes and misconceptions

Sam Akinfala, the middle of three children whose parents are from Nigeria, was born and brought up in Peckham in the London Borough of Southwark - one of the poorest areas in the UK. He went to a boys' comprehensive where 60% of pupils receive free school meals: St Thomas the Apostle College in Southwark. Here he gained 12 grade A\*s in his GCSEs. This was an amazing achievement as no-one in the history of the School had managed this level of exam success, and in 2007 Sam was rewarded with the School's "McQuail Plate," given to the pupil gaining the best GCSE results each year - the 12 A\* grades he gained remains a school record.



Somerville College, Oxford



The Headmaster of St Thomas the Apostle College is part of a forum that liaises with head teachers from public schools to enable the brightest students from state schools to apply for bursary places at independent schools. With no Sixth Form at St Thomas the Apostle College,

Sam was recommended to apply for a full bursary at the City of London School, an independent school with a history of achievement that dates back to the 15th century. With just six places available and over 35 applications, Sam successfully passed the City Of London School entrance exam and interview process and went on to gain five grade As at A Level.

Sam's Headmaster, at the City of London School, Mr David Levin, said: *"Within two weeks Sam looked and appeared as if he'd been with us all his life. He threw himself into everything the school had to offer, particularly football and also in making a huge circle of friends immediately. He was a natural in Maths and Physics, grasping the concepts rapidly and manipulating them splendidly."*

Sam's Science Teacher at St Thomas the Apostle College in the London Borough of Southwark, Mr Cos Smart, highlighted: *"Upon first meeting Sam he informed me that his goal was to be the Head Boy, this was said with such determination*

*and humility that it appeared in no way arrogant. It was clear within weeks, even as a Year 7, that becoming the Head Boy was inevitable and Sam's achievements remain the benchmark towards which all of our pupils continue to aspire"*.

Today, Sam is in his third year at Somerville College, Oxford, studying for a degree in Engineering Science. His tutor at Somerville College, Professor Richard Stone, said: *"Sam is a pleasure to tutor because of the quality of his work and his enthusiasm for it. He is very self-effacing and dismissive of his own considerable achievements. It so happens that I will be supervising his final year project, and I am really looking forward to this as he is most definitely a student who gets results"*.

Here Sam tells his story and through his eyes we can begin to understand how exam success, a passion for learning and positive collaboration between the state and independent sectors go beyond stereotypes and misconceptions.

*"I had never considered Oxbridge before my time at City of London School. I'm glad the ambitious environment there enlightened and motivated me. I remember reading about matriculation and other traditional Oxford activities and immediately envisioning a Harry Potter like set up. It all seemed massively different to my inner city roots. But I fell in love with Oxford at my interviews. In hindsight, I could not have made a better decision in applying to Oxford. I always look forward to wearing subfusc (Oxford has a long tradition of*

*academic dress), formal dinners are fun and Somerville is amazing - a perfect fit"*.

## My Engineering Science course

*"A tricky tutorial sheet question adequately narrates my experience of the course so far. At first sight the challenge the question presents is enthralling, it may require extra reading as the lecture notes may not suffice. It may take hours and often can be frustrating. At the end something tangible is achieved, a lot is learnt and a satisfying feeling relegates the frustration. I can honestly confess that I love what I study"*.

*"For my 3rd year project, I worked on a Control System for a Kinetic Energy Recovery System (KERS) to be implemented in line with the new 2014 F1 regulations. I especially enjoyed the stage where I started using Simulink, which is great for multi-domain simulation and model-based design. I think being wiser with energy is an amazing engineering concept, be it in an F1 car or through 'green energy' development. Hopefully, after Oxford, I will have the opportunity to explore this"*.

## Proud Mother

Samuel's mother Monica, who is a nurse, commented: *"When Samuel delivered the news about his offer from Oxford to me over the phone, I actually screamed. I still remember the excitement I felt. I think I was more elated than he was. Saying that I am proud of him would be an understatement. Even now I still itch to share the good news with family and friends"*.



Professor Andrew Hamilton, Vice-Chancellor, University of Oxford

## "If you have the ability to study at Oxford, we'll ensure money is no barrier"

Consumer campaigner Martin Lewis of MoneySavingsExpert.com and his team at the Independent Taskforce on Student Finance Information compiled a summary of all English university undergraduate financial support packages for 2012. The results show the University of Oxford has the most generous no-strings attached financial support for the lowest-income students of any university in the country. Professor Andrew Hamilton said: *"Oxford's financial package is worth over £22,000 over three years for the lowest-income students. Our approach deliberately*

*combines fee waivers and bursaries in order to provide successful applicants with the support they need - whether it's help with upfront living costs or in overcoming possible longer-term debt aversion"*.

The University of Oxford expects one quarter of all students to get some form of financial support (around 2,500 students based on current numbers). The University estimates one in ten undergraduates will get the maximum support (around 1,000 students based on current student numbers).

# Chris Reddick on ‘enjoying the technical stuff’



My advice to those reading my career profile is if you enjoy the technical stuff, don't be afraid to stay technical, and don't feel the need to rush into team leadership until you're ready for it.

I started in the oil industry in 1976 with Shell, having completed a general Engineering degree at Oxford University (St Edmund Hall, 1973). My first job was in Shell's North Sea operations where I spent five years working offshore and later as an Operational Petroleum Engineer, which provided me with a really solid foundation in drilling and production operations.

After four years with Shell in Oman as a Production Technologist, I joined a small company called Britoil in Glasgow. I started with Britoil as a Reservoir Engineer, having had no prior experience in that discipline. To build my knowledge of hydrocarbon fluids I got up at 5.30am every morning for my first two years to work through two reservoir engineering text books! I chose reservoir engineering because it was a highly sought-after skill in the UK.

## Reservoir Engineer

In 1986 I moved to Aberdeen to work on their North Sea fields through to the time when Britoil was acquired by BP in 1989. In 1991 I joined BP's Exploration Frontiers team in London as a Reservoir Engineer supporting BP's activities in Abu Dhabi and involved in planning for the Vietnam gas fields.

In 1995 I became Team Leader for the giant North Kuwait oil fields as a secondee into the Kuwait Oil Company (part of BP's technical services agreement with them). This was my first Team Leader position, despite having been in the industry for 19 years. One of my pieces of advice to others is, don't feel the need to rush into team leadership if you're keen to establish your technical capability first.



The BP hockey team in Kuwait

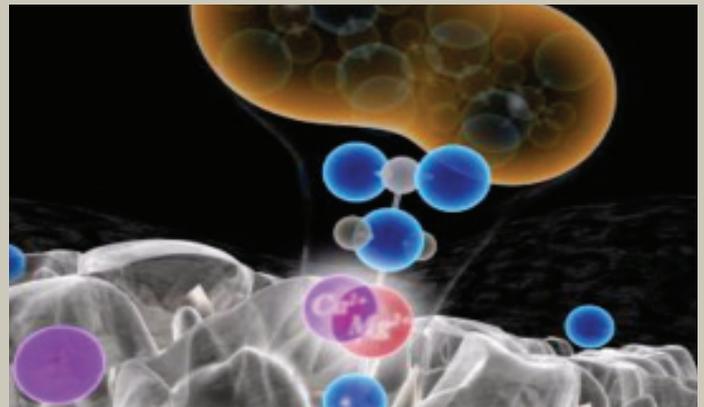
## The BP Hockey Team in Kuwait

One of the great benefits of my spells overseas, particularly in Oman and Kuwait, was the opportunity to see other environments, people and cultures. The density of my experience in the Middle East was far higher than more costly areas like the US and the North Sea. I was proud of establishing the BP hockey team in Kuwait. It took a year to establish (sourcing equipment and people), only to play 60 matches, lose 58, draw 1 and win just 1!

In 1998 I returned to London to BP's Azerbaijan Business Unit to be Team Leader for all the sub-surface activities in Azerbaijan.

## Field of the Future

In 2002 I took on the role of Technology Unit Leader managing 120 people and in 2005 a new group of around 40 technologists – Field of the Future – was created. This is now the model for all the flagships in Upstream. Upstream is our core business - we find reserves of oil and gas, develop the means to extract them and then produce and transport them to market.



## New technological challenges

In 2008 I moved into my current role leading the Pushing Reservoir Limits Flagship. One of our biggest technical challenges is to unravel the fundamental science of what really goes on in the complex pore space of our reservoirs when we inject fluids to improve recovery, and universities have a big role to play here.

**Chris Reddick is BP's Vice President, Pushing Reservoir Limits (PRL)**

BP has a strong relationship with Oxford University, with enduring collaborations in the social and political sciences and a growing number of new collaborations in the mathematical and physical sciences. The Memorandum of Understanding signed in 2010 and the BP-Oxford Steering Committee continue to help build and maintain strong relationships at the University.

An important part of the relationship that BP has with the University of Oxford is with the students. BP has a strong track record of recruiting many engineering graduates into the numerous functions of its business as its next generation of technologists and leaders.

For more information about the exciting graduate careers that BP offers please visit: [www.bp.com/careers](http://www.bp.com/careers)

# Supporting Graduate Students

We are very grateful to all those who have supported the Department's Graduate Bursary Fund, which helps to ease the financial strain for students studying for their DPhil. Our aim is to provide an education for the most able graduate students irrespective of their background or financial circumstances and the Graduate Bursary Fund provides targeted support for students satisfying the twin criteria of academic excellence and financial need.

## Allowed me to focus on my research

Aoife Roebuck is doing a 4 year DPhil at the Institute of Biomedical Engineering. She said, *"I spent the first year of my DPhil looking for part-time work and worrying about funding and expenses, an unwelcome distraction. Luckily, I received funding from several University sources, including the Graduate Bursary Fund, which allowed me to focus on my research on Obstructive Sleep Apnoea. I would like to thank those who have contributed"*.

Michael Ayling (Lincoln, 1960) said, *"I was asked to write a short quote explaining why I supported the Engineering Science Department's graduate scholarships. I realised to my surprise that I really didn't know. As the deadline for my response approached I suddenly realised why..."*

## My way of saying thank you

*My college had no engineering fellow early in the 1960s and I was therefore sent elsewhere for tutorials and as an undergraduate had four tutors. (As an aside their names were LUND, SMART, WISE and WITT and I've always been a little disappointed that Mr Lund didn't have a different name with some affinity to the other three). These four gentlemen were all very good to me. My tutorials always ran over, often extending to 2 or 2 1/2 hours. They were ever patient, well-disposed and of good humour. They answered all my questions and most of them in a manner I could understand. I owe them much and my donation is my way of saying 'Thank you'."*

For more information about this or any other part of the Collegiate University, please e-mail [william.thomas@devoff.ox.ac.uk](mailto:william.thomas@devoff.ox.ac.uk) or visit [www.campaign.ox.ac.uk](http://www.campaign.ox.ac.uk)



# London 2012

Sharan Gill (Balliol College, 2001) works for Transport for London as a Highway Structures Engineer. Here she recounts her journey to Oxford University and her engineering role in the London 2012 Olympics and Paralympics...

My parents were always focused on learning the sciences and they were great influences as I was choosing my GCSEs. While at secondary school I became interested in a career in the Army, which led me to study at Welbeck College (a military sixth form college). I joined up after A-levels and applied for sponsorship to study outside the Army. Unfortunately my Army career was short-lived due to a knee injury.

The Engineering Science degree at Oxford was fantastic. I specialised in Civil Engineering in the last two years, but the breadth of general engineering theory covered over the first two years of the degree continues to help me in my job today.

Throughout my time at Transport for London there has been one behemoth event to plan for; the London 2012 Olympics and Paralympics. I've worked on emergency projects to keep vital London bridges open, inspected structures within the Olympic Park, and volunteered as a Travel Ambassador. For me it was a showcase of almost every type of engineering and a fantastic opportunity to see engineering in action.

I have also been involved in volunteering to promote engineering careers in schools, science fairs and in various media forms. With STEMNET (Science, Technology, Engineering and Mathematics Network), I received a Young Engineers of the Year Award in 2009 from the Royal Academy of Engineering. Transport for London has also sponsored me through a part-time MSc in Advanced Structural Engineering at Imperial College London.

The skills and knowledge I developed during my time at Oxford gave me confidence and the knowledge to pursue 'outside-the-box' solutions to manage our aging and varied structure stock, to providing the solid theoretical background to help me in my continuing studies in engineering.



## Networks

**The University of Oxford's Alumni Office** provides a range of opportunities for alumni of the University to come together. Throughout the year there is an exciting mix of social and professional networking events, presentations by leading academic speakers, as well as the chance to get involved in student recruitment and outreach activities. To find out more please visit: <http://www.alumni.ox.ac.uk>

**The Society of Oxford University Engineers (SOUE)** invites past members of the Department of Engineering Science to keep in touch both with engineering at Oxford, and with one another. Membership is open to all graduates of the Department (including those with postgraduate degrees); undergraduates can join as associate members, becoming life members on graduation. The Society has one main meeting per year, generally in September, which combines the Annual General Meeting with the Jenkin Lecture, usually given by a member of the Society. To find out more please visit: <http://www.soue.org.uk>

**The Oxford University Engineering Society (OUEngSoc)** is one of the largest undergraduate societies in the University. It promotes the engineering profession within the University and provides students with a wider overview of the profession that are otherwise outside the scope of the degree course. Talks, debates and trips as well as socials and networking opportunities are offered to undergraduates. To find out more please visit: <http://www.ouengsoc.org>

## Thank you for your support

We would like to acknowledge the important role played by our individual and corporate supporters, and we thank them for the invaluable contribution they have made to the Department.



The Department of Engineering Science  
University of Oxford, Parks Road, Oxford OX1 3PJ  
Tel: 01865 273000 Fax: 01865 273010  
E-mail: [newsletter@eng.ox.ac.uk](mailto:newsletter@eng.ox.ac.uk) Website: [www.eng.ox.ac.uk](http://www.eng.ox.ac.uk)