

# RESEARCH HORIZONS



In this issue  
**IT ALL MAKES SENSE**  
Cutting-edge sensor research  
and news from across  
the University





## Foreword

Happy New Year! Welcome to the second issue of Research Horizons. Whether you're already familiar

with the magazine or a new reader, I hope you enjoy this issue and welcome your feedback to [Research.Horizons@rsd.cam.ac.uk](mailto:Research.Horizons@rsd.cam.ac.uk)

Research Horizons is a window on some of the world-class research carried out across the University. In this issue the spotlight is on sensor research as a taster for the next Horizon Seminar on 20 March 2007; from measuring volcanic gas emissions to monitoring underground infrastructure, 'A Sensory World' will show how sensors are being applied in diverse and challenging environments. Featuring prominent industry speakers, the Seminar also brings together leading Cambridge scientists and 'rising stars' who are making their mark in this field. Our front cover features one such star, Xiaohan Pan, with the world-renowned Professor Christopher Lowe, whose research into holographic biosensors in contact lenses may revolutionise the way diabetics monitor blood glucose levels.

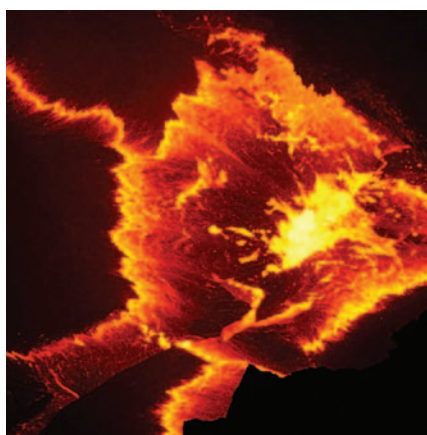
And there's more! From uncovering Victorian attitudes to the past to examining the role of universities in public engagement to cutting-edge research into coronary heart disease, the magazine is packed with exciting and thought-provoking research stories. We hope you also enjoy two new regular features – 'Inside Out' and 'In Focus' – which give an insight into the world of academics and their sponsors.

Whatever your own interest, I hope you enjoy this edition. Be sure to take a look at the new online version of the magazine which is available on the Research Services Division website at [www.rsd.cam.ac.uk](http://www.rsd.cam.ac.uk)

We are also looking for article ideas for Issue 3 of Research Horizons and welcome suggestions. The deadline for ideas is 27 February 2007. Please send submissions to me at [Research.Horizons@rsd.cam.ac.uk](mailto:Research.Horizons@rsd.cam.ac.uk)

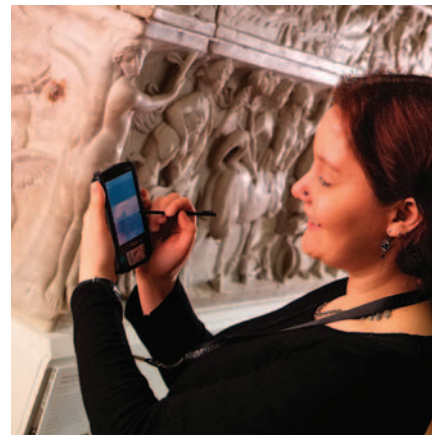
Finally, we'd like to thank everyone who has supported Research Horizons to date. We are delighted with the response to our first issue and look forward to bringing you more breakthrough research from across the University in 2007.

Kerry Tipping  
Editor



DR CLIVE OPPENHEIMER

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Cover photograph of Miss Xiaohan Pan and Professor Christopher Lowe by Keith Heppell  
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## Stem cells and Cambridge

**World experts on stem cell research recently gathered for a two-day symposium to celebrate 25 years of stem cell research in Cambridge and to mark the opening of a new world-class research centre.**



PHOTOGRAPHER: KEITH HEPPELL

From right to left: Professor Azim Surani (Gurdon Institute, University of Cambridge), Professor Tony Green (Department of Haematology, University of Cambridge), Dr Fiona Watt (WTCSCR, University of Cambridge), Professor Austin Smith (WTCSCR, University of Cambridge), Professor Charles ffrrench-Constant (Department of Pathology, University of Cambridge), Professor Roger Pedersen (Department of Surgery, University of Cambridge).

In 1981 two papers appeared that reported the derivation of pluripotent stem cell lines from cultured mouse embryos. Now called embryonic stem (ES) cells, they have since transformed research in mammalian development, genetics, stem cell biology and regenerative medicine.

To celebrate the 25th anniversary of this landmark discovery, the University of Cambridge, in partnership with Nature, held a special symposium. The opening afternoon of the meeting reviewed the history of ES cells and other pioneering contributions on mouse and human embryology in Cambridge, with presentations from the key researchers. The second day focused on current research and future prospects for both embryonic and tissue stem cells. Twelve leaders in the field from North America, Japan and Europe, presented and discussed their latest findings.

Under the leadership of Professors Austin Smith and Fiona Watt, the Wellcome Trust Centre for Stem Cell Research (WTCSCR), Cambridge will pioneer the next generation of stem cell research, encompassing embryonic, foetal and adult stem cells. Based at the University of Cambridge, and with £10 million of funding from the Wellcome Trust, it will be an international centre of excellence in fundamental stem cell research. It is destined to become the leading research centre in Europe and will compete with leading institutes in Japan, Singapore and North America.

The Centre will focus on defining the genetic and biomedical mechanisms that control how stem cells develop into particular types of cell. This will provide foundations for genetic engineering of stem cells to model particular diseases, drug discovery and regenerative medicine. Study of stem cells can improve our understanding of how the human body develops and maintains itself, and of how certain diseases arise. Research in this area offers great potential for future medical treatments.

Professor Austin Smith was previously at the University of Edinburgh where he led a team that developed the world's first pure nerve stem cells made from human embryonic stem cells, a breakthrough seen as important for tackling diseases such as Alzheimer's and Parkinson's.

'Stem cell biology is a young and complex area of basic research with emerging potential for biomedical applications,' says Professor Smith. 'With current US legislation restricting public funding of human embryonic stem cell research, there is a window of opportunity for the United Kingdom to become a world leader.'

Taking the post of Deputy Director at the Centre, Professor Fiona Watt has recently been appointed Herchel Smith Professor of Molecular Genetics at the University of Cambridge. She was previously head of the Keratinocyte Laboratory at the Cancer Research UK London Research Centre. Professor Watt is also Deputy Director of the new Cancer

Research UK Cambridge Research Institute.

The Wellcome Trust has awarded a £3 million grant to Professor Watt. Her team will investigate how the epidermis (the outer covering of the skin) can be stimulated to produce new hair follicles and sebaceous glands. In addition to improving the quality of treatment for burns victims, her research will provide insights into the signals for regeneration and production of other specialist cell types, such as muscle and brain cells. This would enable the development of therapies using adult stem cell alternatives for numerous diseases and conditions.

'We are pleased to support this exciting new centre of excellence for stem cell research,' says Sir William Castell, Chair of the Wellcome Trust. 'We anticipate that the research done at the Centre will make a significant contribution to the global understanding of basic stem cell biology. This knowledge is vitally important and will provide the essential foundations for developing therapeutics in the future.'

An £11 million refurbishment of buildings in central Cambridge provides the home for the Centre, in close proximity to the Gurdon Institute for the study of developmental and cancer biology.

## Architecture Awards

**Three Cambridge academics have won awards in the inaugural Royal Institute of British Architects (RIBA) President's Research Awards.**

Dr Wendy Pullan of the University of Cambridge won the award for Outstanding University-led Research with her work, Conflict in Cities: Architecture and Urban Order in Divided Jerusalem. Her research, funded by the Economic and Social Research Council (ESRC), concerns urban development in Jerusalem, exploring in particular the security wall that traverses the countryside in the region and the main road that runs towards Damascus Gate.

Dr Torwong Chenvidyakam was shortlisted in the outstanding PhD category for 'The Fluid Mechanics of Pre-cooled Ventilation'.

Dr Dalibor Vesely was awarded the Annie Spink Prize for Excellence in Architectural Education. Dr Vesely was a University Lecturer in the Department until his retirement five years ago, but still lectures to Third Year students, and is Director of Studies in Architecture for Emmanuel College.

## University welcomes Well-being Institute

**A new institute dedicated to understanding what factors help individuals and organisations thrive has been launched at the University of Cambridge.**

The Well-being Institute is a new cross-disciplinary initiative which aims to promote the highest quality research in the science of well-being and to integrate this research into evidence-based practice.

Founding Directors Professor Felicia Huppert and Dr Nick Baylis believe that the scientific study of well-being is needed to advance our understanding of how best to lead a life characterised by health and vitality, contribution and fulfilment. Professor Huppert said, 'An enhanced understanding of how individuals and communities can be helped to thrive and prosper would be of great benefit to our citizens, our educators, and our leaders. Only a genuinely scientific exploration of this rapidly evolving field can provide a source of trustworthy information to guide interventions, and the Institute is designed to further these endeavours.'

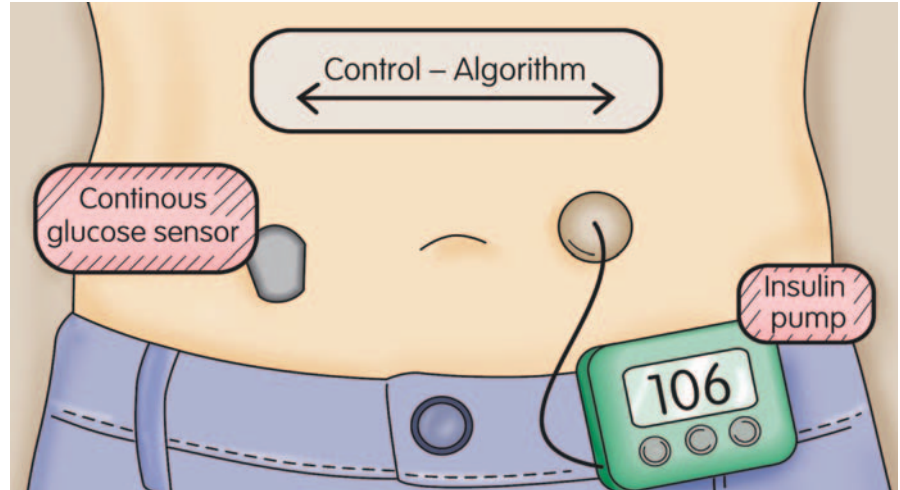
The Institute welcomes leading experts from all disciplines to work with them to create new ways of thinking about key areas of our lives, such as education, healthcare, the workplace or the environment.

The Well-being Institute also seeks partnerships with the public and private sector to develop evidence-based well-being programmes, tailored to their specific needs and evaluated with high quality outcome measures.

**For more information, please contact Professor Felicia Huppert on +44 (0)1223 336970 or go to [www.cambridgewellbeing.org](http://www.cambridgewellbeing.org)**

## 'Artificial pancreas' – hope to diabetic children?

**The University of Cambridge has received £500,000 from the Juvenile Diabetes Research Foundation (JDRF) to fund research into developing an artificial pancreas for children and adolescents with Type 1 Diabetes.**



JUVENILE DIABETES RESEARCH FOUNDATION

If successful, the mechanism will dramatically improve the quality of life for children with diabetes by making it significantly easier to manage the condition and reduce the risk of hypoglycaemia.

Type 1 Diabetes is an autoimmune disorder which causes the body to attack the beta cells of the pancreas, limiting its ability to produce the insulin necessary to regulate blood sugar levels. Multiple daily insulin injections and finger prick blood tests make regulating the blood glucose of children and adolescents extremely difficult: a problem which is further complicated as juveniles are also known to have more severe fluctuations in their insulin need.

With the Department of Paediatrics, Dr Roman Hovorka is leading research into a more precise regulation of blood glucose through the development of an artificial pancreas. The artificial pancreas will couple a glucose sensor with an

insulin pump to create a 'closed-loop' apparatus. Specifically, the artificial pancreas will measure blood sugar levels on a minute-to-minute basis with a continuous glucose monitor. The signal is transmitted wirelessly to a handheld computer, which calculates the right amount of insulin for a given condition. The information on the insulin rate is then further transmitted wirelessly to a pump delivering the insulin.

Clinical trials of the artificial pancreas start in early 2007. These will help perfect the computer algorithm so the glucose sensor can 'talk' to the insulin pump effectively and mimic the work of a normal pancreas. The project will initially focus on overnight laboratory and home use. As a result of this research, it is hoped that an artificial pancreas will enable children to maintain more stable blood sugar levels, reducing the risk of serious complications as well as lead more flexible lives.

## Naked Scientist wins Science Communication Award

**Dr Christopher Smith from the Department of Pathology, University of Cambridge, has been awarded the prestigious Science Communication Award by the Biosciences Federation (BSF).**

Dr Smith was recognised for his extensive work communicating microbiology and other scientific research to the public. Dr Smith is well known for his incredibly popular Naked Scientist BBC Radio series and website, in which

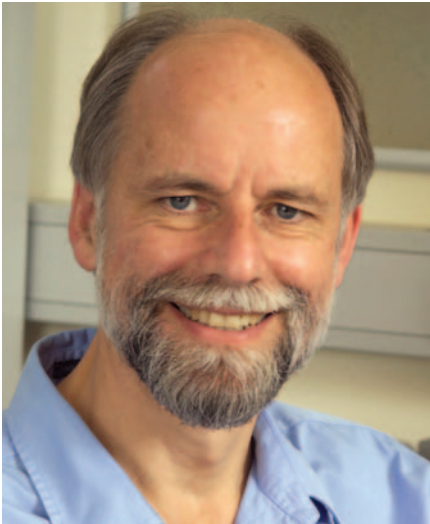
he makes academic science and research accessible and enjoyable for a wide audience. With more than two million podcast downloads in the last 12 months, the series is one of the world's most downloaded science

programmes. Additionally, Dr Smith has recently been working with Nature to podcast breaking science in an understandable way. He also gives talks and scientific demonstrations and acts as an expert on viruses for television and radio.

The Biosciences Federation actively works to influence policy and strategy in biology-based research and is also concerned about the translation of research into benefits for society.

**For more information about the Naked Scientist series, please go to [www.thenakedscientists.com](http://www.thenakedscientists.com)**





## Nobel stronghold announces new head

**A new director has been appointed to head the world renowned Medical Research Council Laboratory of Molecular Biology (LMB).**

Dr Hugh Pelham, a cell biologist, was appointed following an international trawl for an exceptional scientist and leader. After graduating from Cambridge University, Dr Pelham studied for his PhD under Richard Jackson and Tim Hunt, who was awarded the Nobel Prize for Medicine in 2001 for 'discoveries of key regulators of the cell cycle'. Dr Pelham is now head of the Cell Biology division at LMB where he has worked on proteins which help to protect cells against the

damaging effects of heat. In his new role, Dr Pelham will lead the Laboratory during the next stage in its evolution which will include moving into a newly designed building. Dr Pelham is taking over from Dr Richard Henderson who is retiring after serving 10 years as director.

**For more information, please contact the Medical Research Council press office on +44 (0)20 7637 6011 or at [press.office@headoffice.mrc.ac.uk](mailto:press.office@headoffice.mrc.ac.uk)**

## Darwin continues to E-evolve

**Over 10 million hits in the first 24 hours; extensive TV and radio interviews; coverage in over 900 newspapers and news websites – the launch of 'The Complete Work of Charles Darwin Online' on 19 October 2006 created an explosion of media interest worldwide. Dr John van Wyhe, its founder, estimates that news of the website has already reached over 400 million people.**

This level of media exposure certainly helps the project to achieve its main objective: to make the entire works of Charles Darwin – 50,000 pages of searchable text and 40,000 images of original publications – accessible for everyone for free at the click of mouse. This has been a labour of love for Dr van Wyhe and his team who have compiled and transcribed materials from around the world over the course of four years. As Dr van Wyhe explains, 'After securing funding from the Arts & Humanities Research Council (AHRC) a year ago, our aim was to make these important works easily available as quickly as possible. Our philosophy is centred on the premise that most of the value is in the historical work of Darwin itself.'

So what's next? One thing is clear – this project has only just begun. Dr van Wyhe has ambitious plans and a clear vision for the future of the website. Amongst his wish list is the addition of thousands of transcribed handwritten manuscripts, every edition of every book written by the famous naturalist, and manuscripts scanned in high resolution colour.

Dr van Wyhe would also like to gather all reviews of Darwin's publications. As he explains, 'It is only when we have this collection that, as historians, we can get a true picture of what the reception to Darwinism was like.'

With German, Danish, Norwegian and Russian editions being added and



DR JOHN VAN WYHE

potential partnerships with other major collectors of Darwin's books in the pipeline, it is Dr van Wyhe's hope that this website will evolve into a central resource for all information on Darwin globally. And thanks to the ability to monitor all aspects of usage of the website, it will be possible to track how Darwin is being read across the world.

**For more information about 'The Complete Work of Charles Darwin Online', please go to [www.darwin-online.org.uk](http://www.darwin-online.org.uk). 'Darwin Online' is looking for further funding to complete the project. Please visit [www.darwin-online.org.uk/support.html](http://www.darwin-online.org.uk/support.html) for details.**

## CIMR receives £4m Wellcome Trust award

**Clinicians and scientists studying how a variety of human diseases arise have received a major boost in funding.**

The Cambridge Institute for Medical Research (CIMR), University of Cambridge, where researchers look at the underlying molecular and cellular mechanisms behind disease, has been awarded one of the prestigious Wellcome Trust Strategic Awards.

The £4 million grant will enable the CIMR to stay at the leading edge of research into how diseases arise. The Institute is a multidisciplinary research centre whose outstanding feature is the interweaving of clinical medicine with molecular and cell biology. Since it opened in 1998, it has led key research into how viruses evade our immune system, genetic susceptibility to diabetes and progress towards novel treatments for Alzheimer's and Huntington's diseases.

As well as facilitating collaboration between clinicians and basic scientists, the Institute also aims to play a key role in training tomorrow's academic doctors and medical scientists. The strategic award will allow CIMR to run 'Next Generation Fellowships', intended to attract clinicians into research at the conclusion of their clinical training. It will also establish a four-year PhD programme to provide basic scientists with an opportunity to undertake PhD training and explore interdisciplinary research opportunities. **For more information, please go to [www.cimr.cam.ac.uk](http://www.cimr.cam.ac.uk)**

## Investigating cancer in the 21st century

**Cancer remains one of the greatest threats to human health, with over 270,000 new cases being diagnosed each year in the UK.**

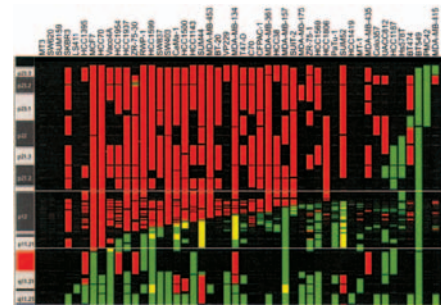
According to Cancer Research UK, more than one in three of us will develop cancer at some point, and few of us go through life without coming into contact with the disease in some way.

At the University of Cambridge, much ongoing cancer research is aimed at understanding the cellular or molecular changes that occur when normal human cells transform into malignant cells capable of forming tumours. Whilst the causes of cancer are diverse, changes to the human genome of individuals can lead to cancer formation. Structural or numerical changes to the genome may be involved in the progression of cancer by altering the extent to which genes are switched on, changing the combination of genes turned on at any one time, or altering the function of genes.

Recent advances in the technologies available to scientists have opened up

new ways to identify genome changes in much more detail than previously possible. Using genome-wide microarray technologies, recent research at the Department of Pathology in collaboration with the Centre for Microarray Resources has shown that it is possible to accurately measure small genome changes in breast cancer and brain tumours. Such studies improve our understanding of cancer progression and may open up new routes for the effective diagnosis and treatment of such cancers.

The Centre for Microarray Resources ([www.path.cam.ac.uk/resources/microarray/](http://www.path.cam.ac.uk/resources/microarray/)) in the Department of Pathology was established in response to a lack of such microarray technologies within the University. It now provides access to high quality mammalian and custom microarray resources and automation, including core human and



A 'normal' chromosome is shown on the lefthand side. Microarray analysis of 48 cancer cell lines shows that structural changes have occurred in the chromosome, represented by changes in the length of green and red regions (from Pole et al. 2006, *Oncogene* 25).

mouse tools and more than 30 custom arrays for bacteria, parasites, plants and mammals.

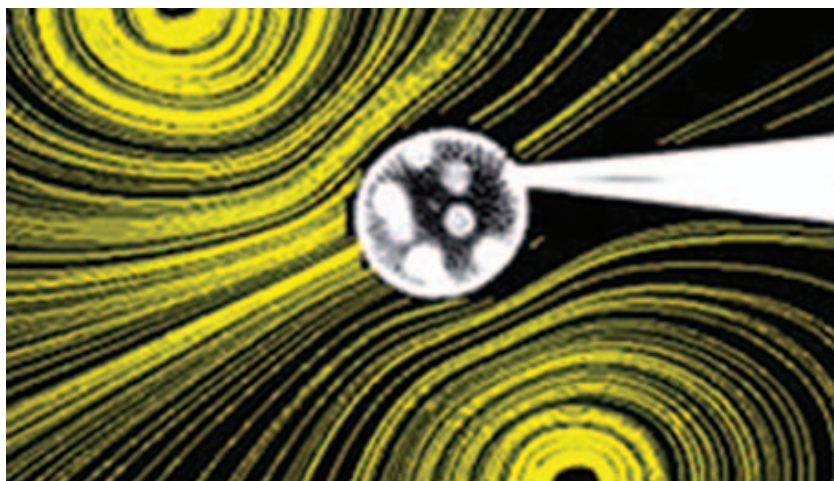
It occupies purpose-built, environmentally-controlled laboratories within the Department of Pathology, increasing its ability to provide a high quality consultation service alongside its capacity for array design, manufacture, experimentation and analysis.

**For more information, please contact the Centre Manager, Anthony Brown at [apcb2@cam.ac.uk](mailto:apcb2@cam.ac.uk)**

## New Horizon for interdisciplinary science

**'The Physics of Living Matter', a symposium on integrative science, recently took place at the University of Cambridge.**

**HORIZON FORUM**



PROFESSOR RAYMOND E GOLDSTEIN AND SUJOY GANGULY

The first in a series of Horizon Forums, the two-day conference gathered researchers from across 15 departments of the University and externally, to showcase the exciting opportunities in cross-disciplinary science.

Against the minimalist background of the Kaetsu Centre, New Hall shone a star line-up of speakers from across the world and a programme filled with a wide range of lively and interesting talks. Leading Cambridge scientists, including Professor Michael Akam (Department of Zoology), Professor Daniel Wolpert (Department of Engineering), Professor

Mike Payne (Department of Physics) and Professor Raymond Goldstein (Department of Applied Maths and Theoretical Physics) outlined their research. The event also included prominent speakers such as Professor Eric Karsenti from European Molecular Biology Laboratory and Professor Scott Fraser from California Institute of Technology.

Three key areas were explored: the structure of living matter, examining the organisation of component molecules of cells; watching living matter, demonstrating several advanced

microscopy techniques; and the activity of living matter, detailing the forces acting on cells in the development of tissue. The common theme running through all the talks was the application of the techniques, methods and general philosophy of the Physical Sciences to Biology.

Sponsored by Research Services Division, the Horizon Forum was organised by Dr Duncan Simpson, Professor Alfonso Martinez-Arias and Professor Peter Littlewood. With over 200 delegates including several major research sponsors, the symposium provided a window on the interactions and networks across disciplines. It clearly showed that there is a lot of Biology going on in Chemistry, Physics and Engineering which may lead to a new integrated discipline in the future.

Horizon Forums are interdisciplinary workshops designed to inspire new generations of research scientists to create innovative projects and collaborations. There will be a second symposium of 'The Physics of Living Matter' and other Horizon Forums on different subjects in 2007.

**For more information, please go to [www.cure.group.cam.ac.uk/matter/index.html](http://www.cure.group.cam.ac.uk/matter/index.html)**



## Universe opens up for University thanks to Kavli investment

The University of Cambridge and the Kavli Foundation® have announced their intention to establish an institute to pioneer exciting new research into the beginnings of the cosmos.



NASA

The Kavli Institute for Cosmology in Cambridge will be supported by a multimillion dollar endowment from the Kavli Foundation which is dedicated to advancing scientific knowledge 'for the benefit of humanity'.

'Cambridge has such a stellar record of making fundamental discoveries in science throughout the ages and, with its traditions of excellence and leading-edge science teams, I have great hope that the Kavli Institute at Cambridge will make major discoveries in the future,' said entrepreneur and philanthropist Fred Kavli, founder of the US-based Kavli Foundation.

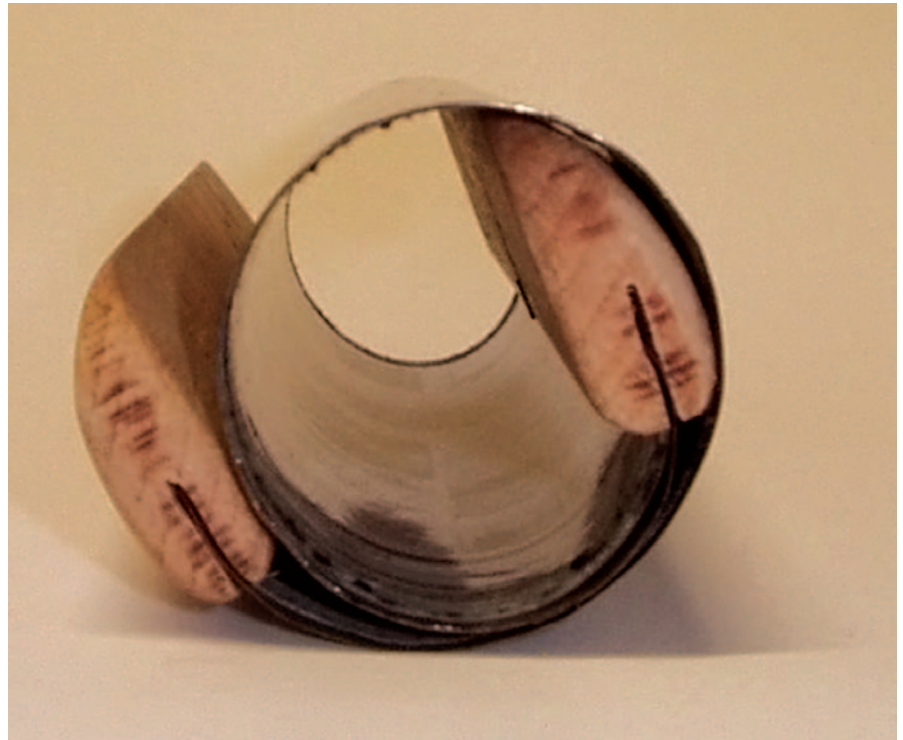
Led by Professor George Efstathiou, the Institute will seek to make major scientific advances in our knowledge and understanding of the universe, bringing together scientists from Cambridge's Institute of Astronomy, Cavendish Laboratory (Department of Physics) and Department of Applied Mathematics and Theoretical Physics.

The Institute will form part of an international network of Kavli Foundation-funded research centres at other universities around the world, and will collaborate with its sister centres in China and the US. This is the first time that the Kavli Foundation has established an institute in the United Kingdom.

**For more information about the Kavli Foundation, please go to [www.kavlifoundation.org](http://www.kavlifoundation.org)**

## Roll up, roll up for revolution in portable technology!

When the news of a breakthrough technology for roll-up laptop screens broke, it was met with immediate and widespread media interest.



DR KEITH SEFFEN

It even caught the scientists responsible for its development at the University of Cambridge a little off guard. 'When I arrived at the Department of Engineering it was just like any other ordinary day ... by the time I left, I'd done an interview with Anglia TV!', Dr Keith Seffen explains.

The level of media excitement around this technology is hardly surprising. Not only is the development of a range of unique, shape-changing structures cutting-edge, but the ease with which they can be manufactured, and the wide range of their applications make this technology very commercially appealing.

These 'morphing' structures afford multiple configurations without the need for complex parts or sophisticated manufacturing. By using an ordinary sheet of metal, Dr Seffen can produce structures with no moving parts but which can be configured between at least two distinct, self-locking and stable forms. For example an A5-sized flat screen can be snapped into the shape of a tube for compact and light carriage in a briefcase or pocket.

Not only does this offer a significant consumer benefit in terms of convenience, but it's good news for manufacturers. Production is inexpensive, uncomplicated by the need for moving parts, heating or chemical processing –

it's simply a mechanical process which can be automated. Dr Seffen also asserts that the 'morphing' structures offer a distinct advantage: 'Compared to other technologies, our structures offer substantial shape-changing capabilities whilst preserving structural integrity.'

The range of applications for this technology is wide. Dr Seffen is currently exploring various uses with co-workers Dr Simon Guest and graduate student Alex Norman, including roll-up display screens (such as laptop screens), re-usable packaging, roll-up keyboards and self-erecting, temporary habitats. Presently, they are focusing on display screens, following considerable interest from manufacturers of incredibly thin, flexible electronic displays. Furthermore, they believe their technology can be extended to a range of portable and popular electronic devices, such as MP3 players and mobile phones, for ultra-compactness.

Assisted by Cambridge Enterprise Ltd, Dr Seffen and his team have filed a patent on the manufacture and operation of their 'morphing' devices, and are actively seeking further industrial collaboration for future development.

**For more information, please contact Dr Seffen at [kas14@cam.ac.uk](mailto:kas14@cam.ac.uk) or go to his website [www2.eng.cam.ac.uk/~kas14](http://www2.eng.cam.ac.uk/~kas14)**

# Leading the way in sensor technology



**The Horizon Seminar 'A Sensory World: novel sensor technologies and applications' will showcase a broad selection of sensor technologies and systems that have been developed at the University of Cambridge. This will take place on 20 March 2007 at The Kaetsu Centre, New Hall.**

From self-parking cars to diagnostic tools for cancer, sensor technology is shaping our future. Indeed, some claim that sensors will change our world in this decade in the way microprocessors did in the 1980s and the Internet in the 1990s.

The Seminar will cover a wide range of sensor perspectives from the basic technology and science of sensor design, applications for diverse situations and environmental conditions, and the challenges associated with rendering meaning from sensor networks or multiple heterogeneous sensing assets.

Examples of cutting-edge sensor applications will be discussed by leading scientists and 'rising stars' from the University who are putting their stamp on emerging sensor technology that will shape future research. The event will also feature prominent external speakers from industry.

The Seminar will provide delegates with a rich diversity of insights, perspectives and experiences as well as the opportunity to meet Cambridge academics and peers from leading companies. A drink reception will immediately follow the lecture series giving a further opportunity to network in an informal setting.

## **About Horizon Seminars**

Horizon Seminars are organised by the University's Research Services Division and provide an exclusive look at new developments in the most exciting areas of science and technology at Cambridge, with a particular emphasis on the cutting-edge interdisciplinary research that could significantly impact the future.

Delegates are given an opportunity to broaden their knowledge by listening to the experiences of a varied group of inspiring speakers who create a dynamic forum for information exchange and meaningful networking. Participants include academics, thought leaders, major research sponsors and industry experts all of whom understand the need to anticipate the latest trends and innovations to stay ahead of the competition.

**For more information about the Horizon Seminar series and to book online, please go to [www.rsd.cam.ac.uk/events/horizon/](http://www.rsd.cam.ac.uk/events/horizon/) or email [horizon@rsd.cam.ac.uk](mailto:horizon@rsd.cam.ac.uk)**



## SESSION 1: BUILDING BLOCKS

This session includes input from groups whose research is at the leading edge of nano- and biotechnology sensing. Talks will cover a range of applications of sensor technology: from monitoring glucose levels in diabetics using holographic smart sensors in contact lenses, to the measurement of pollution emissions, to the detection of proteins which make up the 'fingerprint' of a particular disease or genetic condition such as a propensity towards schizophrenia.

**Xiaohan Pan**  
Institute of Biotechnology  
**Dr Florin Udrea**  
Department of Engineering  
**Dr Ashwin Seshia**  
Cambridge Nanoscience Centre

## SESSION 2: MEASUREMENT

Ever tried measuring gas emissions from a lava lake inside a volcano, or the temperature of flames within a jet engine? Session 2 will showcase some of the unique measurement challenges being undertaken by groups across the University, where existing sensing technology has been coupled with new techniques to create novel solutions for securing information which was previously unobtainable.

**Dr Clive Oppenheimer**  
Department of Geography  
**Dr Johan Hult**  
Department of Chemical Engineering.  
**Dr Kenichi Soga**  
Department of Engineering  
**Professor Rod Jones**  
Department of Chemistry

## SESSION 3: DATA

A sensing system is only useful if the information it relays possesses meaning. Sensors of various kinds are becoming ubiquitous, and all of these sensing systems produce data. Without the means to interpret this information, the advantages this technology offers are limited. Session 3 examines some of the approaches being taken by researchers to look at this challenge.

**Dr Simon Godsill**  
Department of Engineering  
**Dr Andy Stanford-Clark**  
IBM Labs

## SESSION 4: A SENSORY WORLD

From transport systems to mobile phones, the use and application of sensor technology is ever increasing and we are moving towards an information society in which sensing will affect the daily life of the individual. Session 4 will attempt to look over the horizon and explore some of the opportunities and challenges raised by a pervasive sensor infrastructure.

**Dr Tapani Ryhänen**  
Nokia Research Centre  
**Dr Robert Harle**  
Computer Laboratory

## Modern day alchemy: Gold for 2012?

Have you ever wondered what makes an elite athlete? There are many important factors – natural aptitude, physical capabilities, and access to good facilities to name but a few. But these days there is also a team of coaches and sports scientists who work alongside an athlete to turn that tattered certificate from school sports day into the dazzling spectacle of an Olympic gold.

Sports science has moved the sporting world on significantly in the last few decades, with many of the advances driven by technology. Some changes are apparent to even the most casual observer – rubber running tracks, lighter racquets, aerodynamic suits. But behind the scenes, technology has been making an arguably bigger impact in coaching. It has allowed us to better understand physical actions (think slow motion video), the body's response to training (think physiological monitors such as heart rate recorders) and to quantify those all-important tactics.

However technology for sports science is in its infancy. Much of it involves moving an athlete to a specialised environment; running on treadmills instead of tracks, cycling on machines not bikes. There is an unfortunate 'Heisenberg effect' that accompanies this – it is difficult to measure an athlete without affecting what he or she is doing. The result is that many of our elite athletes use only the eyes of their coach in training, making the odd visit to a sports science laboratory to check on progress. Naturally, the next step is to take the technology to the athlete.





**An ambitious research project headed by the University of Cambridge's Computer Laboratory and Department of Engineering aims to revolutionise sports coaching using advanced sensor networks.**



**Dr Robert Harle**

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 or go to  
[www.cl.cam.ac.uk/research/dtg/sesamewiki](http://www.cl.cam.ac.uk/research/dtg/sesamewiki)

### Introducing SESAME

In 2006, a consortium comprising the University of Cambridge's Computer Laboratory and Department of Engineering, UCL Computer Science Department, UWIC Sports Sciences Department, and the Royal Veterinary College was awarded a multi-million pound Engineering and Physical Sciences Research Council (EPSRC) grant for a project called SESAME (SEnsing in Sport And Managed Exercise).

SESAME is an ambitious four-year project that aims to use sensors both on and off the athlete to capture and present new performance data in near real-time. Crucially, the athlete will not be required to perform outside of their preferred environment or to use any performance-simulation machinery.

This new approach will permit SESAME to concentrate on the aspects of sporting performance that have proven hard to measure in a laboratory. Ever tried sprinting on a treadmill, for example? For safety reasons, we don't recommend it! It is exactly this inability to simulate the performance of high-power, short duration events such as sprinting and jumping that limits sports science today.

SESAME will address this using a variety of sensors. Sensors in the environment will remotely track an athlete, training a range of synchronised high-speed video cameras on him or her and recording the data for immediate review. Sensors on the athlete – measuring limb speed, acceleration, position, and physiological signs – will be integrated into a local Body Sensor Network (BSN) transmitting data wirelessly to a nearby infrastructure and on to the coach and sports scientists. SESAME will gather, store and distribute an array of performance data, presenting it faster and in more detail than ever before.

In consultation with top coaches, the consortium will use its experience across research domains to build the system that coaches and athletes need. This brings with it many technical challenges. In gathering data, studies must be undertaken to understand which sensors are useful and reliable. Anything integrated on to the body must have low power consumption and be very small and lightweight as a typical sprint shoe weighs less than four AA batteries. The next challenge is to transfer the data from the BSN to the surrounding infrastructure in real-time, accurately time-stamping it and logging it to a permanent, secure record. Once that is in place, interest shifts to how this information is presented to coach and athlete in an efficient manner: an athlete may only have a minute to spare between repetitions, so he or she needs the information fast and in a digestible form.

### The Impact of SESAME

To understand the role that the SESAME system might play, it is useful to understand the role of a good coach. Ultimately, this is to enable an athlete to perform at his or her optimum at a given time. It is tempting to imagine that a machine might be capable of this, but a cursory inspection of the literature will reveal the staggering complexity inherent in modelling a human, let alone in optimising their performance. In addition, the best coaches are those that recognise individuality – every athlete is different in stature and in their physical response to training – leaving no global optimum to seek. SESAME has no ambition to replace the coach. Rather, it seeks to assist them by providing new, relevant and timely data.

As an example, consider the way coaches today observe their charges. They watch from a variety of viewpoints, each carefully chosen to provide different information about the athlete's technique. Naturally an athlete's performance at the end of a session may be somewhat inferior to that at the beginning so coaches must decide whether the faults they observe are important errors or just signs of fatigue. The video recording aspects of SESAME can significantly contribute to this observation. By using multiple cameras placed at points chosen by the coach, many viewpoints may be gathered at once and synchronised to present them immediately following each repetition.

But this is only half the challenge. It is also likely that there will be no time to review this information in detail so SESAME must present the video in a useful format, with the salient features highlighted. To do this, researchers plan to integrate the data gathered by the BSN, which is used to spot oddities such as a bad contact, an unusual lean, or an anomaly in the motion and flag the corresponding video sequences. The coach and athlete will then be in a position to immediately review the highlighted oddities with a view to addressing their cause in the subsequent repetition, or review the entire video in slow motion if they wish.

After-the-event review is also possible. By data mining the extensive volume of data collected, scientists hope to spot comparable sessions in terms of speed, distance, or recovery and compare them to gain a profile of an athlete's progress both individually and relative to others in the system.

There is little doubt that should SESAME achieve only half of the goals it has set, it will be a useful weapon in the arsenal of the modern day coach. And maybe – just maybe – it will contribute to a very golden 2012.

# Remote sensing in extreme environments

**Sensor technologies are being applied in ever more challenging environments but they don't get much more extreme than a 3800-metre-high volcano in Antarctica.**



DR CLIVE OPPENHEIMER

Infrared spectrometer at Mount Erebus, Antarctica

Mount Erebus, on Ross Island (from where Scott set out on his doomed journey to the Pole in 1911), is one of the most active volcanoes on Earth, with a more or less permanent lake of lava constantly churning within its summit crater. Lava lakes are particularly simple volcanic systems – in essence, the lake is connected to a larger reservoir of magma by a feeder pipe – and they can remain stable for decades, even centuries. This steady behaviour and geometric simplicity makes them particularly amenable to investigations of the basic processes operating beneath active volcanoes.

The lava lake on Mount Erebus emits a steady stream of hot gases, which forms an acid cloud stretching downwind from the crater. The chemical composition of such effluents provides many clues to what goes on beneath a volcano: how and where molten rock is transported within the Earth's crust, and why volcanoes erupt in different ways. At Erebus, there is also interest in the extent to which the volcanic 'pollution' affects the pristine Antarctic atmosphere – the volcano never switches off, so there is a continuous output of chemically reactive gases into the atmosphere that may, for instance, affect ozone concentrations.

Since 2003, scientists from the volcanology group in Cambridge have been engaged with the US Antarctic

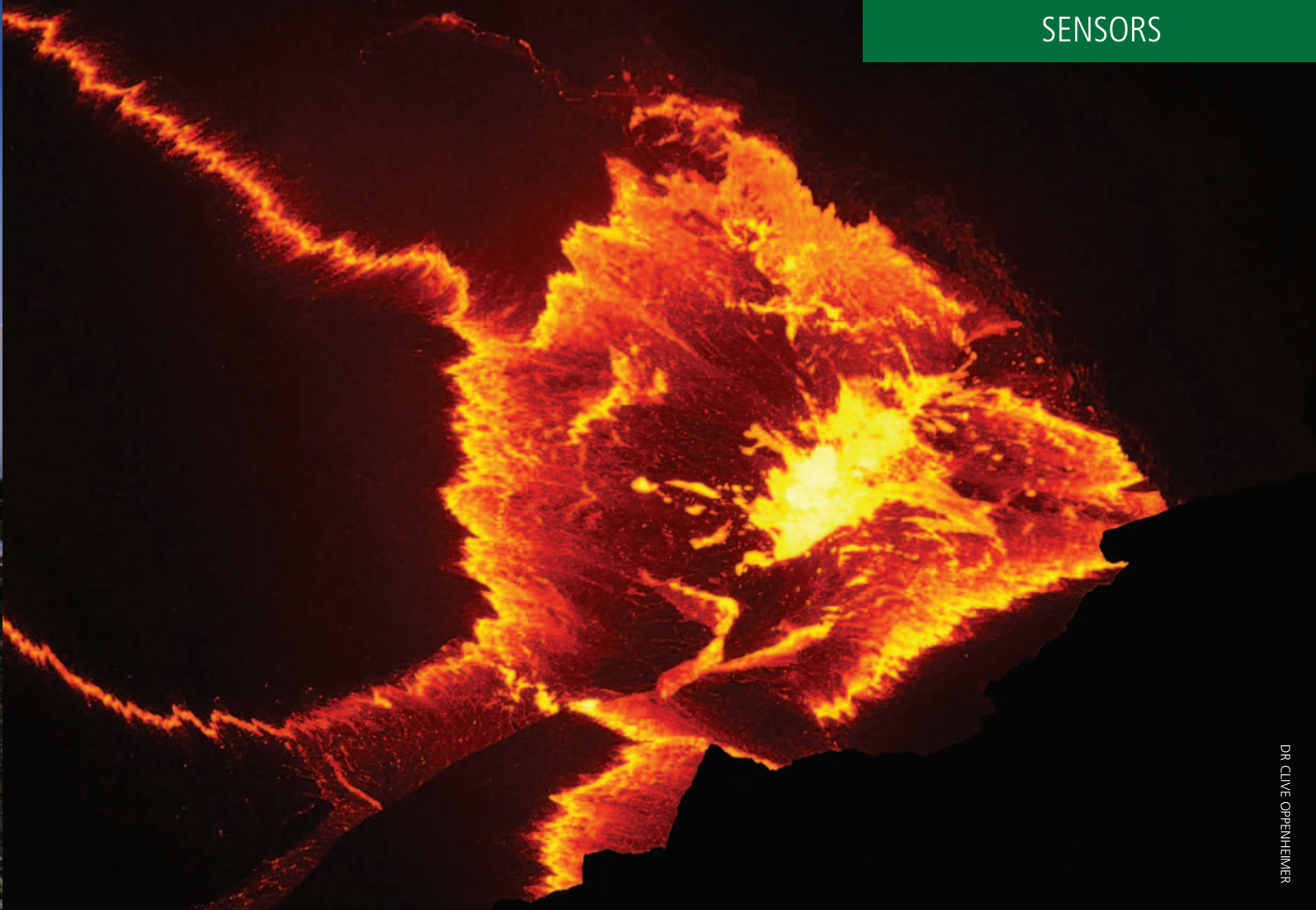
Program, tasked with measuring the gas discharge from Erebus. But the challenge is how to make observations of emissions from a 1000 °C lava lake at the bottom of a 200-metre-deep crater, at an altitude of four kilometres above sea-level in Antarctica, where the ambient temperature is typically minus 35 °C. Not to mention that the lava lake sporadically explodes showering the upper flanks of the cone with lava bombs!

One attractive solution is the long-established technique of 'absorption spectroscopy', in which gas molecules are detected and quantified according to their ability to absorb certain frequencies of light – in this case infrared light. The method has been used in chemistry labs for decades but used to involve bulky equipment unsuited to transport and operation on the side of a volcano. Military requirements to detect potentially harmful gases in battlegrounds led to miniaturisation and ruggedisation of the spectrometers so that they could be mounted on remotely piloted aircraft and flown into the action. These compact instruments have proved very resilient to the rough treatment and immersion in corrosive gas plumes typical of fieldwork on volcanoes. Above all, they enable measurements to be carried out remotely, increasing the safety margin for field scientists. At Erebus, this approach is



**Dr Clive Oppenheimer**





Erta 'Ale, Ethiopia

unearthing some extraordinary secrets of the volcano's plumbing system, and why it occasionally explodes.

The instrument used on Erebus is about the size of a shoebox. It is attached to a telescope and mounted on a tripod sited right at the edge of the crater, so that it can be tilted to view the lava lake, across a distance of about 300 metres. The incandescent surface of the lake provides abundant infrared light, some of which is absorbed by the volcanic gases before reaching the spectrometer. One important aspect of the technique is the ability to make a measurement every second. This allows detection of the very rapid variations in gas emission that are associated with explosions.

Although most of the time Erebus emits gases calmly from its lava lake, a few times a day, large bubbles of gas – some over 30 metres across – arrive at the surface of the lake where they burst, violently expelling clots of molten lava around and sometimes beyond the crater. The spectroscopic measurements reveal that these bubbles have a very distinct gas composition – especially in respect of the proportions of carbon dioxide and carbon monoxide – compared with the gas released routinely between explosions. This observation suggests that the explosions result from

accumulation of gases deep within the volcanic conduit feeding the lava lake, which then travel rapidly to the surface due to their buoyancy. Such insights are extremely valuable in understanding how volcanoes work, and why they can change their behaviour so suddenly.

There are presently two other volcanoes on Earth with long-lived lava lakes. One is in the Great Lakes region of central Africa. The other is Erta 'Ale, sited within the Danakil Depression of Ethiopia. Here, the environment is as hostile as Antarctica in many ways – through extreme heat rather than cold. Less than 100 kilometres away is the salt mine of Dalol, distinguished for roasting in the highest annual mean temperature ever recorded on Earth – over 34 °C. The Cambridge volcanologists have used a combination of infrared and ultraviolet sensors to measure both the gas and heat emissions from the lava lake of Erta 'Ale, revealing that the lake experiences remarkable cycles of activity. These last about 30 minutes and consist of an interlude of rather calm circulation of lava, which is punctuated by vigorous convection that entirely resurfaces the lake with fresh lava within a few minutes.

Comparable cycles have been recognised in the gas and heat observations from Erebus. Such trends

suggest that the flow of molten rock into the lava lakes is unsteady, with globs of fresh lava periodically entering the lake and releasing heat and gas. Alternatively, the cycles could result from trains of gas bubbles rising up the feeder pipes. Either way, when volcanoes exhibit cycles they are revealing key aspects of the transport of molten rock and the separation and behaviour of gas bubbles – crucial controls on the nature of volcanic activity.

Thorough analysis of the observations from both Erebus and Erta 'Ale is in progress and promises fundamental insights into the inner workings of active volcanoes. A better understanding of volcano behaviour contributes directly to forecasting volcanic activity and assessing the hazards that volcanoes pose to society. Although they are among the most remote volcanoes on Earth, these investigations of Erebus and Erta 'Ale using advanced sensor technologies can make a valuable contribution to understanding volcanoes elsewhere on Earth.

**For more information, please contact Dr Clive Oppenheimer, Department of Geography at [co200@cam.ac.uk](mailto:co200@cam.ac.uk) or go to his website at [www.plinian.com](http://www.plinian.com) This research is sponsored by the National Science Foundation Office of Polar Programs and US Antarctic Program.**

# Revolution in near-patient diagnostics

Today, diagnosis is based on the measurement of a range of chemical parameters in accessible biological fluids such as blood and urine. In most cases, the samples are sent to a central laboratory for analysis and the results become available minutes, hours or even days later. Such delays can hamper timely diagnosis and impede medical decision-making. Nevertheless, a typical hospital laboratory has evolved over the years into a fully automated system of sample collection, bar coded patient identification, sample pre-treatment and passage via high throughput computer-controlled instruments. Human intervention is now limited to engineers rather than biomedical scientists.

However, in recent years, there has been something of a quiet revolution in diagnostics practice, with a discernible trend to take tests to the patient. Technological advances in assay chemistry, sensor and transducer platforms, electronic processing, instrumentation and miniaturisation has seen the emergence of 'alternate site' diagnostic testing in the ward, outpatients, surgery, home, and workplace. This type of near-patient testing, or point-of-care (POC) testing as it is now known, is set to expand dramatically. POC testing can reduce the cost per test by 35% with additional savings in manpower. It simplifies the steps involved in sample handling and has been proved to reduce the turn-around-time for cardiac markers from 72 hours in the central laboratory to 20 minutes patient-side, with clinical decisions made proportionately quickly.

POC testing is likely to be preferred in situations where rapid diagnostic monitoring can improve medical decision-making. For example, in A&Es, it may be used to measure drugs-of-abuse in critically ill patients who need to be assessed and treated quickly. Similarly, POC testing can be applied to monitor patients on anticoagulant therapy in the operating theatre where time is of the essence. POC testing is also an attractive option where the frequency of monitoring necessitates sample taking close to the patient, such as in a physician's office, care home or patient's home. Other recommended applications range from testing for diabetes to pregnancy to inflammatory diseases. The diversity of potential near-patient tests suggests that POC systems must offer a

Holographic indicator for heart problems; in the presence of a marker for myocardial infarction a blue cross appears in the heart.



**Good health is a basic human requirement for a high quality of life. Diagnostic tests and procedures are vital tools in the armoury of the physician to help confirm or rule out affliction with a medical condition.**



**Professor  
Christopher Lowe**

broad portfolio of tests. The question is what technology platform can accommodate such a plethora of diagnostic tests to generate rapid, accurate, reliable and fool-proof clinical data.

At the University of Cambridge, research at the Institute of Biotechnology is investigating biosensors as one of the principal contenders. A biosensor is an analytical device which uses a physico-chemical transducer to convert the recognition of an analyte directly into an electrical signal. Cambridge scientists are concentrating on simplified and generic biosensor platforms that will find application in a wide range of POC tests.

Holographic biosensors are at the cutting edge of this research. Pioneered by a multi-disciplinary team of physicists, chemists and biochemists at the Institute, the concept is based on using reflection holograms which respond to all classes of analyte including ions, gases, enzymes, metabolites, oligonucleotides, antigens and whole cells. Holographic sensors can be fabricated as test strips which provide changing optical images to indicate the test result. This approach is unique in the field of biochemical sensors: the hologram per se provides the analyte-specific response polymer, the optical interrogation and reporting transducer all in one robust, inexpensive and easily manufactured sensor.

Currently these sensors are being developed for POC testing of the key clinical analytes, patient self-testing, and for roadside and first responder testing for pathogens. However, an interesting feature of the holographic sensors is that holographic images can be made to appear or disappear under an appropriate chemical or biological stimulus and be used to display visual interpretations of the analyte concentrations. Obvious applications for these visual indicators include breathalysers, and the monitoring of heart conditions and diabetes. A further important extension of this programme is to develop holograms for indwelling catheters, subcutaneous sensors and contact lenses for minimally invasive real-time monitoring of glucose in diabetes management.

The Institute also has a strong focus on developing diagnostics for complex neuropsychiatric disorders, such as schizophrenia and bipolar affective disorder. This is a particularly challenging

area for several reasons: diagnosis is usually via interpretation of a complex behavioural and cognition questionnaire by a competent clinical psychiatrist; there are currently no known clinically accepted biochemical markers for these disorders since biomarkers for brain dysfunction are not obviously found in readily accessible biological fluids; the disorders manifest themselves slowly over extended periods of time and their onset may be dependent on environmental, dietary and lifestyle triggers; and finally, the efficacy of current therapies are at best somewhat serendipitous and the patients tend to be non-compliant and resistant to patient testing and care.

Nevertheless, the work of Cambridge scientist, Dr Sabine Bahn has already identified a number of promising biomarkers in cerebral spinal fluid (CSF), serum and peripheral tissues and it is expected that these will form the basis of a new category of psychiatric diagnostics. It is anticipated that near-patient POC technology will eventually measure a panel of genetic, protein, metabolite and drug analytes and benefit this branch of psychiatric medicine in a number of ways. It will: identify genetic susceptibility to these disorders, predicting the risk of developing the condition; offer pre-symptomatic diagnosis, and prognosis; allow patients to be stratified according to patient, drug and dose type; monitor patient response and compliance with treatment regimes; and finally, identify any adverse drug reactions at an early stage. Thus, neuropsychiatric disorders and other complex medical conditions are amenable to 'personalisation' in that therapeutic regimes can be tailored to the individual patient following analysis of their genetic and pharmacokinetic profiles.

The effect of POC testing can also be assessed in terms of the overall clinical outcome. It is clear that POC technology can impact faster decision-making, allow treatments to commence earlier, improve compliance, reduce the incidence of complications, optimise treatment, reduce re-operation or re-admission rates, improve patient satisfaction and ultimately reduce the costs of healthcare provision.

**For further information, please go to [www.biotech.cam.ac.uk](http://www.biotech.cam.ac.uk)**

# CUE help young entrepreneurs make 'sense' of business

**Cambridge University Entrepreneurs (CUE) organise the most successful student-run business planning and creation competitions in Europe. Since 1999, CUE has had over 450 entries and has awarded £280,000 in grants to 31 business ideas. These companies have raised more than £8 million of further funding and are currently valued at more than £22 million.**

What happens when you bring together a licensed amateur radio operator, a short film director, a young man who spent most of his childhood 'rescuing' busted electronics from dumpsters and a business competition? A revolution in sensing technology that takes chemical detection into the 21st century.

The Owlstone detector is a unique, penny-sized device that can be programmed to detect a wide range of airborne chemical agents even in extremely small quantities. Using leading nanofabrication techniques, this complete chemical detection system is a hundred times smaller and a thousand times cheaper than existing technology. The detector is manufactured exclusively by Owlstone, a 'spin-out' company of the University of Cambridge, which was founded by three engineering researchers, Andrew Koehl, David Ruiz-Alonso and Billy Boyle.

With double-digit growth forecast in US Government spending on chemical detection over the next decade, Owlstone's success continues to gather momentum. However, Billy Boyle is the first to admit that their entrepreneurial spirit and vision for the next generation of chemical sensing applications were not enough in the beginning. 'We knew we wanted to set up a company but didn't know how to go about it,' he explains.

In 2003, the trio entered the Cambridge University Entrepreneurs (CUE) Business Creation Competition with the idea for a company developing revolutionary miniaturised chemical sensors to detect chemical warfare agents and explosives. They had a firm idea for the technology and identified a strong market demand in the light of terrorist attacks worldwide. But with no business experience, the friends looked at how CUE might be able to help.

Billy asserts that the Competition was an important stepping stone on the road to establishing Owlstone. Not only did the workshops develop essential business skills, but mentoring from experienced

professionals further inspired and motivated them. As Billy explains, 'The contest provided us with a structured framework to find the answers to our questions and a support network of people who had already started up their own businesses. It's one thing to read a book on the theory but to learn from other people's real life experiences is invaluable.'

Advice and practice on how to pitch to potential investors has also proved a critical experience for Owlstone. As Billy points out, 'You can have the best technology but if you can't pitch the whole proposition then it won't matter. The quality of the pitch will often make or break a deal.' It is clear that the business acumen Billy and his colleagues acquired through the Competition has stood them in good stead. At the end of 2003, they finished runners-up, armed with a business plan and a network of mentors and potential investors. Within six months, they successfully secured \$2 million in first round funding from the venture capitalists, Advance Nanotech, Inc ([www.advancenanotech.com](http://www.advancenanotech.com)).

Since then, Owlstone have continued to go from strength to strength ([www.owlstonenanotech.com](http://www.owlstonenanotech.com)). The range of applications for their chemical sensing technology is virtually limitless. The solid-state detector is based on patented innovations that allow a complete analytical sensor to be built on just two silicon chips – one for the sensor itself, and the other for its associated electronics, together with an ionization source. With this patented technology – known as Field Asymmetric Ion Mass Spectroscopy (FAIMS) – gas is ionized and passed through the sensing chip. By programming the device with suitable drive signals, individual gases can be detected quickly in very small quantities. The detector's drive signals and signal processing can be 'fine tuned' to recognise the unique signature of virtually any gas – or range of gases – whether airborne or dissolved in water or other

## Winners of the 2005/2006 CUE Business Creation Competitions

### CUEBiC

- **CamStent:** incorporated in 2006, CamStent Limited is a Cambridge University start-up that is commercialising a non-stick coating technology for coronary artery stents. For more information, please go to [www.camstent.com](http://www.camstent.com)
- **MARGO:** MARGO Technologies was founded in 2006 as a spin-out from Cambridge University Engineering Department to design and deliver audio restoration solutions to the wireless industry. For more information, please go to [www.margo-technologies.com](http://www.margo-technologies.com)
- **m-clic:** m-clic offers a secure, standardised and network-independent financial transaction system for mobile devices. For more information, please go to [www.mclic.com](http://www.mclic.com)

### 3P

- **Bunot Co.:** Bunot Co. aims to develop a soil erosion control net made from waste coconut husks. This enterprise is environmentally friendly and will benefit the coconut farmers in the poor rural areas of the Philippines by generating revenue in the rural economy and providing new livelihood opportunities.





One of the original founders of Owlstone, Billy Boyle (right) and his colleague Russell Parris

fluids. Initially Owlstone technology is being targeted at areas of defence and security. However, the sensor also has many potential non security applications – say as a smoke detector or a breath tester for diseases.

Owlstone continue to maintain strong links with the Business Creation Competition. As well as sponsoring the event, Billy has also been a speaker at subsequent contests and recognises the importance of this. 'One of the biggest boons of the Competition was that we heard talks from people who had already started companies a year or two ahead of us. It proved that entering the Competition is not just an academic exercise – that setting up your own successful business is achievable.'

The CUE Business Creation Competitions focus on team building, writing business plans, pitching for investment and raising the funding to create a business. They take place during the Lent and Easter terms and have two categories: 3P and CUEBiC. Both categories reward propositions that show practicality, financial viability and strong teams.

The 3P (People, Planet, Productivity) Business Creation Competition rewards propositions which focus on creating social or environmental benefits. These businesses may be either for profit or not for profit. CUE will award one prize of £5000 which is tied to the creation of the business. The CUE Business Creation Competition (CUEBiC) rewards high growth propositions that show a strong likelihood of receiving venture capital or business angel investment. CUE will award up to three prizes of £5000 – the prize monies are tied to the creation of a business.

**The CUEBiC winners also have the opportunity to pitch onstage to a panel of business angels and early stage investors to win money from the CUE Angel Prize Fund and also for investment funding. The deadline for 3P & CUEBiC First Round Submissions is 19 February 2007. For more information, please go to [www.cue.org.uk](http://www.cue.org.uk)**





Macaulay's New Zealander engraving by Gustav Doré

## ‘What have the Victorians ever done for us?’

**Modern Britain was invented sometime between 1830 and 1900. It's not just a question of industrialization, compulsory education, the right to vote (at least for men) or the growth of towns, important as all those particular processes were.**

The 19th century has also given us almost all our most familiar institutions, our ideas about ourselves and our history, and the very fabric and rhythm of our lives.

From the rituals of royal celebrations, through Sunday afternoon museum-visiting to our unquestioning assumption that the hour of the day will be the same in all parts of the country – all these and more were the brain-children of those ever resourceful Victorians. Before the late 19th century ceremonials such as coronations and royal funerals were tawdry and often badly-organised affairs; the pomp and pageantry we now enjoy is no throw-back to some distant ‘Merrie England’ (indeed Merrie England itself was a Victorian invention), but to the modernizing court of Victoria and Albert. Likewise the idea that twelve o'clock should strike at the same hour in Glasgow or Exeter as it did in London hardly seemed pressing until the demands of railway timetabling made it so.

To take this from a Cambridge perspective, many of the subjects we now study (from philosophy to engineering) were first defined by energetic Victorian reformers. So too was the division of the Tripos into two parts, the basic university career structure, the idea that undergraduates should all follow the same terms between the same dates, the possibility that dons could marry or that women could study. There is a good chance that restricting the pleasure of ‘walking on the grass’ over college lawns to fellows only was also a Victorian innovation.

A group of Cambridge researchers has recently been awarded more than a million pounds from the Leverhulme Trust for a five-year project to investigate Victorian Britain – and particularly how the Victorians created such a radical version of the future, at the same time as they agonized over their relations with the past.



Entitled 'Past versus Present: Abandoning the Past in an Age of Progress', the project has taken as its logo a wonderfully evocative engraving of the 1870s by Gustav Doré, itself illustrating an earlier whimsy by Lord Macaulay. In 1840 Macaulay had imagined, far into the future, that 'a traveller from New Zealand shall, in the midst of a vast solitude, take his stand on a broken arch of London Bridge to sketch the ruins of St Pauls.' It is an image that captures the nuance and sophistication of Victorian thinking about the passage of time. Not only does it conjure up a future in which the present will have become the ruined past, but it heralds too the possibility of staggering geo-political change. For here the erstwhile imperial subject from the distant colonies is treating the wreckage of London's past imperial greatness as a suitable theme for some dilettante sketching – much as the 19th-century elite would themselves take pleasure in sketching the ruins of (say) ancient Greece or Rome.

The project will be exploring different avenues across the whole range of Victorian engagements with the past, and trying to make connections between them. At its heart is an intriguing paradox. For, at the same time as 19th-century technology and economic developments were raising the prospect of a giant leap into the future, exactly the same tools and processes were opening up – through archaeology, geology, education, biology – all kinds of new pasts in incredible profusion and vexingly contradictory detail. Darwin was controversially theorizing the origin of mankind, at the same moment as archaeologists in the 'Near East' were digging up material traces of the biblical past and Heinrich Schliemann was claiming that he had found proof that the stories of the ancient Greek Homeric epics were actually true – attracting in the process a fan club that extended as far as Prime Minister William Gladstone.

How did people accommodate all these different pasts – and possible futures? It was a problem that engaged not only the elite of Victorian society, but – in an increasingly democratic world that was generating 'popular history' in large quantities for the first time – a wide spectrum across all social groups. Big questions were debated. What was the fate of empires (one vivid answer was of course provided by the Doré engraving)? What was the history (and future) of socialism? But these questions were raised in other forms too. What deserved to be in the local museum? Should old buildings be



Professor Mary Beard



Line sketch of Dr Schliemann giving account of his discoveries at Mycenae before the Society of Antiquities at Burlington House. Illustrated London News, 31 March 1877

demolished to make way for 'improvements'? What did fossil-collecting reveal about the country's past? Should endangered animals or people be preserved?

Hasn't all this been done before? Not in this way. Of course, there are all kinds of distinguished scholarly studies of parts of this agenda, and the project inevitably builds on those. But what the generous grant makes possible is some new, interdisciplinary 'joined up thinking' about the Victorian period. In a new designated research space in the midst of the main Arts' Faculty site, the project brings together researchers from different disciplines, each with a stake in the 19th century. This means not only historians in the strict sense of the word (Peter Mandler of *Caius* provides the lead here) and historians of science (with Jim Secord, of Darwin fame), but also literary critics (headed by Clare Pettitt of Newnham and Kings College, London) and crucially classicists (Mary Beard and Simon Goldhill of the Classics Faculty, both of whom work on the history of classical scholarship). So far they have been joined by three post-doctoral fellows and three more are in the process of being appointed.

The aim of this project is to transcend the boundaries that now tend to divide those working on the Victorian period, putting classics and theology – burning concerns to almost all of the Victorian elite – back into the centre of the picture. By thinking about what history meant to the 19th century, we may also become clearer about what it means to us.

**For more information, please contact Professor Mary Beard at [mb127@hermes.cam.ac.uk](mailto:mb127@hermes.cam.ac.uk) or any member of the group; details at [www.victorians.group.cam.ac.uk](http://www.victorians.group.cam.ac.uk)**



# The University and its publics

**The question of 'public engagement' for universities is rising up the political agenda. Universities are increasingly being asked to demonstrate their work in knowledge transfer with community groups and the public, as well as with business.**

## Science and technology – public engagement

'Blind faith in the men in white coats has gone and isn't coming back.' This statement by the polling organisation, MORI describes the damage to public trust in science following controversies in the media concerning BSE, GM foods and the MMR vaccine among others.

In response to this mistrust, a plethora of 'public engagement with science' initiatives have recently emerged in the UK. At its most ambitious, this activity aims at the open exchange and sharing of knowledge, ideas, values and beliefs between scientists, the public(s), stakeholders and decision-makers.

'Sciencewise' is a Government programme which illustrates a growing commitment from policymakers and scientists to engage the public 'upstream' with consultations on new technologies. In addition to seeking advice from scientists and social scientists (as provided by the Cambridge University Government Policy Programme, for example), there is a national programme of public dialogue on issues of scientific concern. The University of Cambridge actively supports this as demonstrated by its sponsorship of the 'Nano Jury UK' last year. A five-week long citizens' jury on nanotechnologies gave the public the opportunity to become part of the debate as to how this emerging and potentially revolutionary technology should develop.

The University also holds a number of public talks, discussions and debates each year, publicised through events such as the Cambridge Science Festival and the Darwin Lecture series.

## Future scientists

The downward trend in the number of school pupils studying science and embarking on scientific degrees and careers is another incentive for scientists to engage new audiences. In the last 10 years, 21 physics departments have been reportedly closed at British universities.

According to a Royal Society survey (2006), pressures on scientists to spend time on research and teaching act as a barrier to getting more involved with public engagement of science. This is not true for the University of Cambridge. Over 1000 scientific staff and students are involved in 50 or more science educational outreach projects at the University.

The 'Millennium Maths Project' works with hundreds of schools throughout the UK – its web resources received 6.4 million visits last year. The Department of Physics has a year-round programme of educational outreach activity, including its popular Physics at Work days each September which bring in 2500 school pupils to meet commercial and academic scientists. The Cambridge Science Festival takes place every March, during National Science and Engineering Week, attracting over 25,000 visitors of all ages to 100 free events throughout the University. These initiatives cross-over with the University's widening participation and aspiration-raising work, and involve pupils of all ages from primary school upwards.

The University's Humanitarian Centre is a new initiative bringing together research and outreach work for community benefit worldwide. Fifteen relief and development organisations including 'Engineers without Borders' and 'Architecture sans Frontières' are collaborating on sharing resources and placing students in positions to offer humanitarian assistance.





Visitors of all ages at the annual Cambridge Science Festival

### Arts, humanities and social science

The arts, humanities and social sciences often by their very nature engage with the wider community and they play a complementary role to the sciences in engaging with audiences external to the University. In fact, much of the understanding of good practice in public engagement with science has come from social studies of this field. Dr Robert Doubleday is a social scientist who until recently was based at the Centre for Nanoscience. Now at the Department of Geography, he works with scientists to investigate the social and ethical dimensions of their research. He was also active in the 'Nano Jury' project.

Numerous researchers in arts, humanities and social sciences interact with external audiences regularly as part of their studies, and the results often directly impact on the wider world. The University's Centre for Family Research is one such example, with its close connections with the health service, the education system, child and adult psychiatry, clinical genetics, adoption and family lawyers.

The University museums are active in engaging the public with the impressive collections held by the University for the benefit of all. The University is a significant investor in 10 museums and collections for the local community. The Fitzwilliam Museum receives 300,000 visits each year and their initiatives include taking art to patients at Addenbrooke's Hospital and planning virtual visits to the Museum for inmates at nine English prisons. Notable other cultural amenities for the public provided by the University include Kettle's Yard, the ADC Theatre and concerts at West Road Concert Hall. At the University Library, half of its readers' tickets are held by people who are not University members but are eligible to use the Library for academic research.

Modern languages were dropped as a compulsory school subject in 2002,

leading to widespread concern that students will not be prepared with language-learning skills for the future. In response, the University Language Centre has worked with six schools in Cambridgeshire to offer teaching in a language that their school cannot offer otherwise. This scheme is rolling out to north-east England and other locations.

The Cambridge Schools Classics Project was established in 1966 and has played a vital role in keeping Classics in UK school education by creating innovative teaching and learning materials.

And finally, not to be outdone by the popularity of the Cambridge Science Festival, a Festival of Arts, Humanities and Social Sciences – or as it might be configured, a 'Festival of Ideas' – is planned at the University in October 2008.

### The future

Now that the University's public audience exists on a local, national and global scale, can we move beyond the 'show and tell' and 'parallel play' model of community engagement? Can we continue to enter into 'genuine collaboration with community partners in fields which may be long-term, uncertain and genuinely risky', as David Watson, Professor of Higher Education Management at the Institute of Education urges universities to do?

Pro-Vice-Chancellor Dr Kate Pretty certainly thinks so: 'The University's public engagement work stretches back over 150 years and more, looking back to the foundation of our Continuing Education programme and the whole area of work, including examinations worldwide, are now run by Cambridge Assessment. These important parts of the University's work are still going strong today and there is now a huge range of public engagement initiatives accessible via the Cambridge for All portal.'

**Universities play an important role in public life and interact with external audiences in numerous ways, from carrying out research on topics of civic benefit to educational outreach initiatives with school pupils.**



NEIL TURNER

**Nicola Buckley**  
For more information, please contact Nicola Buckley, Festivals and Outreach Co-ordinator (njb1010@cam.ac.uk) or go to [www.cam.ac.uk/cambforall](http://www.cam.ac.uk/cambforall)

# Hope for hearts

**In the UK, someone has a heart attack every two minutes.**



Across Europe, millions of people are diagnosed with myocardial infarction every year, with blood clots in arteries causing more deaths than any other disease. In the face of such alarming statistics, are we really any nearer to understanding why some people are more prone to blocked arteries than others? The Bloodomics project, co-ordinated at the University of Cambridge, aims to address this important question.

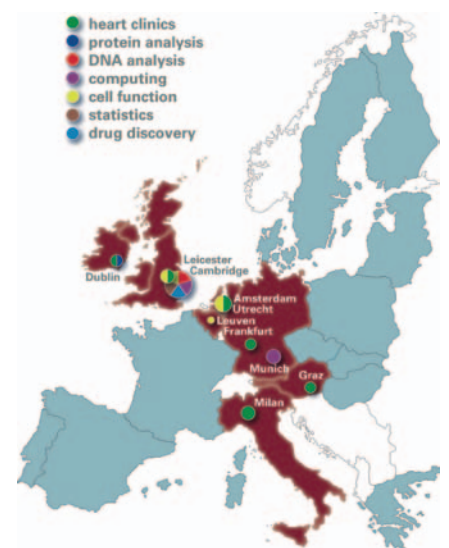
Heart attacks are caused by clogged arteries. If a blood clot forms in a coronary artery, the heart is not supplied with enough blood and suffers from oxygen and energy loss which can prove fatal. Known risk factors for heart attacks include smoking, diabetes and high blood pressure. It is also widely acknowledged that there are genetic risk factors for heart disease. Bloodomics researchers want to understand why some people are more susceptible to forming blood clots in their coronary arteries than others by focusing their efforts on the smallest blood cell – the platelet.

Platelets help to make blood clot and stop bleeding if a vessel is injured. But they also play a major role in clot formation that can lead to heart attacks and strokes. Dr Willem Ouwehand who works at the Department of Haematology and co-ordinates the Bloodomics project says: 'We realised in early 2000 with the imminent completion of the human genome project that there was a great

opportunity to delineate the relationship between platelet gene sequence variation and the risk of clot formation in the coronary arteries.'

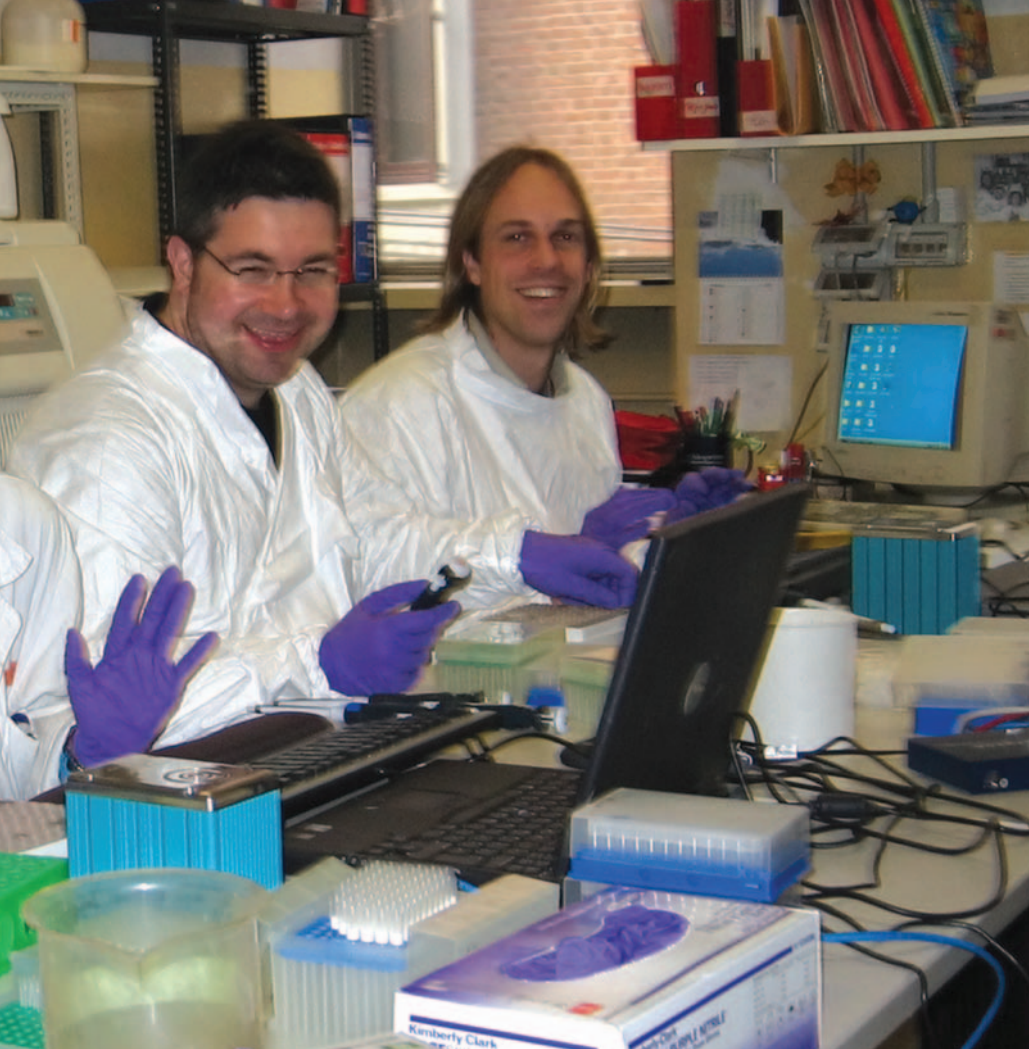
This led to the Bloodomics project, one of the biggest European efforts in the research of platelets and their role in clot formation. The project builds on the leading role of Cambridge in platelet research and is funded by a nine million Euro grant from the European Union. A consortium of 14 partners across Europe have joined forces for four years to discover the genetic markers that will identify people who are at risk of clot formation and myocardial infarction. The project also receives broad support from other fund providers such as the British and Dutch Heart Foundations, the Wellcome Trust, the Medical Research Council (MRC), as well as National Health Services R&D.

For the first two years of the project, the Bloodomics researchers have worked towards identifying up to 400 candidate genes by analysis of all genes which are switched on in the platelet precursor cell, the megakaryocyte. The next important step is to understand which of these contribute to the risk of blood clots. To achieve this, the Cambridge team has worked with leading cardiologists and brought together thousands of DNA samples from five unique clinical collections of patients with myocardial infarction across Europe. The central



The Bloodomics consortium consists of 14 partners across Europe.





The Bloodomics 'family' – researchers from Cambridge and Milan

Bloodomics DNA repository at Cambridge now contains 18,000 DNA samples from patients and healthy controls.

It is already known that platelets from some individuals respond slowly, while those from others are hyper-reactive. However, it remained a mystery how this different behaviour is programmed in the cell and how this corresponds to the risk of blood clots. To track down the genes that modify platelet function, Bloodomics researchers have applied modern genome technologies such as microarray, high throughput sequencing and proteomics, to the analysis of platelets of 500 healthy individuals in great detail. This has led to the discovery of novel proteins which may play an important role in controlling platelet function. The next step for the Bloodomics project is to compare DNA from myocardial infarct patients with that of healthy individuals. As Dr Ouwehand explains, 'We have defined a long list of candidate genes but we have to verify which ones are really associated with clot formation in coronary arteries.' This will lead to further studies in model organisms, like zebrafish, to better understand the function of these genes over the next two years.

One of the challenges but also the strengths of this project is the interdisciplinary expertise of the team. The project has over 180 researchers in seven European countries bringing together scientists with cardiologists,

bioinformaticians with mathematicians and geneticists with protein engineers. As Dr Kerstin Koch, the assistant project co-ordinator explains, 'Our partners not only speak different native languages but also approach questions differently depending on their scientific discipline. Over the past two years, we managed to bring all these varied perspectives together to build a strong team. This makes the Bloodomics 'family', as it is often called, very special.'

An essential contribution to the 'family' is made by statisticians from the MRC Biostatistics Unit in Cambridge and the bioinformaticians at the Wellcome Trust Sanger Institute (WTSI). As Dr Koch points out, 'We are looking at platelets from all angles so there is a huge amount of data generated. The real challenge has been to integrate this information in a way that enables scientists to reap the full wealth of the data.' Building on the leading role of the WTSI in informatics has been critical to the success of the project. The bioinformatics infrastructure serves as the central communication platform and offers novel tools to the scientific community to study the complex relation between gene sequence variation, platelet function and the risk of clot formation in coronary artery disease. For optimum convenience, all the system's applications can be accessed through a single web-based portal from anywhere in the world. Security is ensured through token

controlled authentication. As Dr Koch asserts, 'As biologists or clinicians, we would not be able to interpret the data generated by a project of this size without sophisticated informatics. It provides us with innovative solutions to interrogate our data in a secure way.'

Crucially, Bloodomics is not only focusing on the causes of heart disease. Research into the development of new and safe drugs for the prevention and treatment of arterial clot formation is being carried out in parallel. The development of rationally designed human antibodies with anti-thrombotic potential is already underway with the antibody engineering company Domantis ([www.domantis.com](http://www.domantis.com)), a spin-out from the MRC Laboratory of Molecular Biology.

By doing this, the project is hoping to contribute to the early identification of individuals at risk from coronary artery disease and to improve diagnostic and therapeutic options in their care as quickly as possible. As Dr Ouwehand asserts, 'The main objective of the Bloodomics project is to rapidly translate our results into the clinic and to make our contribution to the prevention of one of the major diseases of modern society.'

## Bloodomics

For more information about the Bloodomics project, please go to [www.bloodomics.org](http://www.bloodomics.org)

# Guiding muses – using technology in cultural spaces



Tamsin Pert

**Museums are familiar spaces to many of us but do you ever stop and think about how you find your way around the exhibits and what you take in en route? Do you stick to a well-trodden path around the familiar and the famous, or do you wander at random through galleries to discover new treasures? Do you stop to read the information boards, or pick up an audio-guide at the entrance? Or do you prefer a less directed mode of interaction and interpretation? Whatever method you favour, the introduction of Information and Communication Technologies (ICT) has the potential to change radically the museum experience.**

To understand how, an interdisciplinary team at Cambridge University has been awarded an Arts and Humanities Research Council (AHRC) grant to run three workshops entitled 'Discursive Formations – Place, Narrative and Digitality in the Museum of the Future'.

The application of ICT to broaden and enhance visitor access to museums and galleries is a priority for the sector. However, while significant funds are being made available for museums and galleries to make digital copies of objects and materials, the core of museums' work is still in the display and arrangement of real objects in physical locations. The art of display in museums involves using space as a medium for communication; translating historical or cultural interpretations of objects into physical arrangements which can be read as the visitor explores the gallery space.

Already, digital technology is beginning to find a place in museums in the form of e-guides and digital information points which augment the glass cases and printed labels. These devices alongside the near-obligatory website increase the level of interpretation and interaction available before, during and after your visit. The rise of ubiquitous computing and increased affordability of digital technologies will doubtless see further developments in the integration of smart-media in the museum context: to be successful and enhance the experience of museum visits, these technologies must not become sideshows or simply extensions of the museum guidebook.

Why the focus on museums? Well, the possibilities raised by the integration of digital media in the museum context have implications not only in the world of museum display but also in the research and design of computer user interfaces. For example, research into the physical organisation of museums carried out by the Department of Architecture's Digital Studio has been extended to the development of computer graphical user interfaces, in collaboration with Microsoft Research, which attempt to bridge the gap between the screen and the information it displays. The integration of digital media into physical contexts is a central concern of research into new technology, particularly in the rapidly expanding fields of ubiquitous and embodied computing.

Museums provide rich environments for the study of interface technology because of the complex way in which visitors are asked to read and interact with the 'object orientated' displays and the multifaceted way a museum communicates to the visitor; both through the layers of information each



object and assemblage of objects represents and the contexts for discussion provided by the often communal museum space. Museums also present a wide range of environments in which to explore the use of digital technology. In Cambridge alone, each of the 10 University museums has a distinct personality with commensurate priorities and needs. Each is – to varying degrees – a place of research for academic scholars as well as a venue for schools education and visits





FITZWILLIAM MUSEUM

which can provide a way of guiding the visitor around the museum; highlighting associations between exhibits, providing context, and directing people to galleries that they would not perhaps have otherwise visited. The potential for development is exciting and could combine 3D imaging technologies with new interface and collaboration tools in imaginative ways; providing a personal visit log, a school-group with a webpage, or even bringing a suit of armour to life! To explore such potential the Fitzwilliam invited undergraduates in the University's Computer Laboratory to design a prototype next-generation museum guide aimed at young children; this helped the museum to see new possibilities and the students to put tangible design theory into context.

However, to address the contextual and environmental issues of ICT in the museum properly called for additional expertise in spatial design and awareness. Dr Alan Blackwell, who supervised the Computer Laboratory students, also co-directs Crucible, a network that encourages interdisciplinary collaborations of technologists with researchers in the Arts, Humanities and Social Sciences. The main focus of this collaboration is on design as a meeting point for widely differing research disciplines. Crucible's links with the Department of Architecture therefore provided the other important element needed for 'Discursive Formations'. Dr François Penz leads a study that encompasses film history, virtuality, architectural theory and much more. Work in the Department's Digital Studio explores the use of the moving image and digital media for research in design, communication and visualisation. For 'Discursive Formations', Dr Penz and colleague Maureen Thomas will draw on research into the relationship between knowledge and spatial configurations to explore narrative space and storytelling in the museum context, while Dr Blackwell will investigate the types of digital devices that can be used to augment the museum space.

All three workshops will take place at the Fitzwilliam Museum; each building on the last and structured around practical explorations of the galleries and their exhibits. 'Discursive Formations – Place, Narrative and Digitality in the Museum of the Future' will take place in March 2007.

**For more information, please contact Dr François Penz at [fp12@cam.ac.uk](mailto:fp12@cam.ac.uk)**

by a more general public. Therefore any 'intermediary' that is introduced to these spaces must respect these distinctions as well as serving each audience. Such distinctions are multiplied as you move across the Eastern region, so the Cambridge workshops will draw on expertise from other relevant research projects and partners in the East of England Museums Hub to stimulate cross-institutional discussion.

The idea for 'Discursive Formations' came about through discussions

between the University's Fitzwilliam Museum and the Computer Laboratory, where there was an existing link to the Department of Architecture's Digital Studio. The Fitzwilliam has, for some time, been investing in an ICT programme that aims to provide full access to information on collections while developing a range of imaginative resources that engage the visitor. Margaret Greeves, Assistant Director of Central Services, and her team have introduced tools such as the eGuide,



# Re-thinking the past, present and future

**Understanding our biological past is a tricky business. It's like trying to build a jigsaw puzzle when most of the pieces are missing.**

**However, bioarchaeologists at the University of Cambridge are doing just that through the study of human-environment interactions within a historic and prehistoric framework, often with surprising results.**

The 'Niah Cave Project' is one such example. Led by Professor Graeme Barker and primarily funded by the Arts and Humanities Research Council (AHRC), this project looks at the bioarchaeological record of change in Sarawak, Borneo over a period of 45,000 years. Niah Cave comprises a series of enormous caverns in what is now known as Niah National Park. With clear evidence of long-term human use, these caverns have produced the oldest human skeletal remains found anywhere in Southeast Asia.

Findings from this ongoing research shatter the traditional image of early Modern Humans as 'primitive' hunter-gatherers; as opportunistic foragers whose search for food was limited to only what was readily available. The extensive range of food remains – charred plant tissues, nut and fruit fragments, starch grains, molluscs, and bone fragments of large and small mammals, birds, bats and fish – provide striking evidence of effective foraging strategies in the challenging environment of a tropical rainforest. From the remains of monkey bones and tools left in the cave, we can tell that early

foragers hunted in an organised and sophisticated way, developing methods not only to obtain food on ground level but also high up within the forest canopy. Processing toxic plants as well as managing the landscape through forest burning is further evidence of the ability of the Niah Cave occupants to make good use of the resources available and experiment with subsistence strategies.

So our picture of early Modern Humans is significantly evolving as a result of ongoing bioarchaeological research. Early foragers showed the ability to forward plan and adapt, challenging previous thought on human-environment evolution which asserted that humans did not exploit their environment until the advent of farming. As Dr Ryan Rabett who works on the project explains, 'As our understanding and appreciation of the past becomes more sophisticated, we are continuously being asked to re-evaluate our perception of how the relationship between humans and their environment has evolved over time.'

As well as offering valuable insights into our biological past, rather surprisingly,







PROFESSOR GRAEME BARKER

much bioarchaeological research involves a close correlation with studies in the present. We are what we eat, so the saying goes, and that was as true thousands of years ago as it is today. Fortunately for bioarchaeologists, the type of diet eaten by an individual leaves an identifiable chemical 'signature' in skeletal and other remains. Funded by the Wellcome Trust, Dr Tamsin O'Connell is helping to decipher these signatures and add more to their meaning. Her research measures the chemical signals in consumer (human or animal) tissues that can be linked to the food they have eaten or the water they have drunk. These signals can be related to either the food or water itself or its source. This analysis of ancient diet can provide a host of information about food, subsistence strategies, demography, economy and environment.

The key technique is that of isotope analysis. Common elements such as carbon and nitrogen exist in different isotopic forms, which are present at stable ratios within the environment. Within living organisms, however, the

isotopes are processed and integrated into body tissues in subtly different ways. As a result, the isotope ratios within different plants and animals tend to deviate from environmental norms in distinctive ways. Analysis of these ratios in tissues can thus provide information about diet, position in the food chain and other factors. In archaeological specimens, therefore, isotope analysis can provide clues to ancient dietary habits.

To analyse ancient diets, there needs to be a solid understanding of how the chemical signals get into the different parts of the body commonly found at archaeological sites such as bone and hair. This is achieved through studies on modern diets and body tissue. A better understanding of the links between diet and isotopic ratios in people and animals today provides key baseline data for work on prehistoric specimens.

This technique is also of interest to ecologists studying modern animal populations. As Dr O'Connell explains, 'Bioarchaeologists use this technique to gain information about consumers from the consumers themselves. We do this

because we can't ask them – they are dead. A lot of ecologists are now trying to answer questions about animal populations – they can't ask them because they can't speak, and it is difficult to track them all the time. By analysing the isotopic signal across animal whiskers, for example, we are able to build a picture of their diet and subsistence strategies over their lifetime.'

Modern issues of resource, environment and biodiversity sustainability are areas to which bioarchaeology is making an increasing contribution, as growing knowledge and understanding of the past relates to the present day. Horse breeding is an excellent example. Horses have played a significant part throughout human history. Before the development of firearms the horse was crucial to warfare; before the invention of the steam engine it was the fastest and most reliable form of land transport. Today its importance in the undeveloped and developing world has scarcely diminished and even in the developed world it is of great economic importance to sport and leisure industries.

Right: Horses in Mongolia

Below: Dominique Rogers, Deborah Walker and Eclipse



DR MIM BOWER



DR MIM BOWER

In addition to studies which focus on gaining a greater understanding of the past history of horses, research is also being undertaken which is critical for the existence of present and future generations of horses. The field of archaeogenetics, where genetics methods are used to answer archaeological questions, is playing a key role in this. Boosted by funding from the Isaac Newton Trust, a DNA project, led by Dr Mim Bower, is analysing whether remote, isolated populations of horses preserve the genetic signature of extinct horse populations and whether this can tell us about how, where and when horses were domesticated in the past. This data is also crucial to conservation genetics as many horse breeds in central Asia have become extinct in the last 50-60 years and more are likely to follow.

An ancient DNA study of historic thoroughbred horses, including Eclipse, the stallion described as the greatest racehorse of all time, is also underway. In a Horse Racing and Betting Levy Board funded project on genetic variation in thoroughbred horses, scientists from Cambridge University and the Royal

Veterinary College hope to understand what makes thoroughbreds more susceptible to bone and ligament diseases or more likely to break down in training; research with positive implications for the future.

Bioarchaeological research into crops may also hold the key to sustainable, renewable energy resources for the future. Using modern and ancient DNA, Cambridge bioarchaeologists are leading investigations into the spread and ancestry of crops. With Professor Martin Jones, Dr Diane Lister has been looking at the spread of wheat and barley cultivation as part a Natural Environment Research Council (NERC) funded consortium grant in collaboration with the National Institute for Agricultural Botany and two other universities. Funded by the Wellcome and Leverhulme Trusts, Dr Harriet Hunt researches the domestication of broomcorn millet. With the developing world's focus on 'green energy' from renewable sources, these crops are becoming of more interest for ecological reasons as potential candidates for 'biofuels' and studies into their past origins and spread could prove valuable to future research in this area.

One thing is clear – ongoing bioarchaeological research at the University of Cambridge not only increases and often challenges our understanding of our biological past. It also invites us to rethink our approach to contemporary issues such as conservation and sustainability and in some cases, by looking to the past, we may find the key to the future.

**Much of the bioarchaeology research currently being undertaken in the University of Cambridge is funded by the AHRC, NERC, Wellcome Trust, Leverhulme Trust, Isaac Newton Trust, The International Society for Science and Religion, and The McDonald Institute for Archaeological Research. Investment by the Leverhulme and Wellcome Trusts is also exemplified by the Leverhulme Centre for Human Evolutionary Studies in its new home, the Henry Wellcome Building.**

**For more information, please go to [www.arch.cam.ac.uk](http://www.arch.cam.ac.uk) and [www.mcdonald.cam.ac.uk](http://www.mcdonald.cam.ac.uk)**





Dr Danielle Turner with Professor Peter Atkins, Professor of Chemistry, University of Oxford.

# Dr Danielle Turner

**Dr Danielle Turner recently won the 2006 Times Higher Young Researcher of the Year award for her work on psychostimulant medications.**

**Danielle was a postdoctoral research associate in the Department of Psychiatry at the University of Cambridge and completed a PhD in psychopharmacology under the supervision of Professors Barbara Sahakian and Trevor Robbins in 2005. She now works as the Cambridge Neuroscience Co-ordinator at the University.**

## **It's said you always remember a good teacher. Who helped to set you on your academic career path?**

*The person who first inspired me about research was a lecturer I had as an undergraduate. He was in oncology and his wife had died of cancer. He was the most humble researcher – he wasn't motivated by the glory or the credit. After seeing his wife suffer, he simply wanted to find answers to help other people with cancer. It was really inspiring to meet someone who was so passionate about research and didn't want any of the accolades.*

## **What would others be surprised to learn about you?**

*I trained as a pharmacist but I've never taken conventional medicine. Most people find it bizarre that I've never taken an aspirin or paracetamol and yet I study drugs and can dispense them.*

## **Who or what inspires you?**

*Nature and natural beauty inspire me. Going outside and looking at the incredible complexity of even the simplest thing like a plant or a tiny organism often wows me. In terms of people, Nelson Mandela with his enormous ability to forgive is an inspiration for me. I grew up in South Africa and to be there when the first free elections were being held and see him take a country which was on the brink of falling apart and inspire people to forgive the past and move forward was amazing.*

## **Have you ever had a Eureka moment?**

*No. In fact, this question brings to mind a quote from Isaac Asimov: 'The most exciting phrase to hear in science and the one that heralds new discoveries is not 'Eureka!' but 'That's funny!' And in some ways that's what my science has been like. For example, when I first identified modafinil as a potential alternative cognitive enhancer for treating patients with schizophrenia, it certainly wasn't a case of 'Eureka! This is the drug that's going to do it.' Rather, I thought it was strange that modafinil was clinically similar to methylphenidate but didn't have the same mechanism of action. It was only two years later that I thought, 'Wow, this actually works!'*

## **What's the best piece of advice you've ever been given?**

*Part of my school's philosophy was that every pupil has something exceptional about them and it was the school's responsibility to find out what it was. This approach has been instilled in me and still influences my interactions with people today. I believe that everyone has something of huge value to offer and you should try and find out what that is, rather than write them off because you don't share the same opinions.*

## **If you could wake up tomorrow with a new skill, what would it be?**

*I'd love to improvise jazz. It's something I'm really envious of people being able to do. I play the cello but as a classically trained musician, it's one of those hurdles I think I'll never be able to overcome. In research, learning new techniques is half the fun sometimes, so waking up and just being able to do something would perhaps be less rewarding. I'd still love to be able to do it though!*

## **What motivates you to go to work each day?**

*The people I meet. Even though research is interesting, it often has very delayed rewards – you may only find something out in a year's time. What really keeps me motivated is that every day I have the opportunity to share and bounce ideas off the people I meet at work.*

## **What will the future look like in 2050?**

*My vision is that we will be more tolerant and encouraging of diversity. I hope the increase in global communication, through the internet for example, will enable us to move outside of our small spheres of influence and be impressed by what else goes on in the world.*

*'Winning the Philip Leverhulme Prize will enable me to develop a project which has grown organically from research which I have already undertaken. As a comparative historian, I am interested in the period 1500 to 1800 and specifically, what informed people's decisions when considering opportunities at home and abroad.*

*It is often difficult to do this type of research because it involves archival investigation in a variety of different places across the world and also requires longer periods of time to engage with archival and secondary material.*

*The Philip Leverhulme Prize offers an exceptional opportunity by allowing me to excuse myself from faculty teaching and spend a year or so in the archives, researching and developing my project. At this early stage in my career, it will, hopefully, help me prepare and see to press my next book and as such, is a huge contribution to me as an early stage researcher.*

*The Leverhulme Trust dares to trust people in the early stages of their career without imposing excessive obligations on awardees. The Trust allows one to ask the bigger questions in your field – and this is the only way we can hope to make leaps forward in our subjects. The Trust respects the researcher and as such imbues one with a certain level of professionalism to know that what results will have a contributive value to the subject area. As such, the Leverhulme Trust is truly quite exceptional.'*

Dr William O'Reilly,  
Faculty of History

## The Leverhulme Trust

**The Leverhulme Trust makes awards for the support of research and education. The Trust emphasises individuality and encompasses all subject areas. In 2006, the Leverhulme Trust has awarded 19 grants to the University of Cambridge. Dr Anne Dean is Assistant Director of the Trust.**



THE LEVERHULME TRUST

I joined the Trust as Assistant Director in January 2003 and, nearly four years later, remain amazed and inspired by its impact on the academic world.

My own path to the Trust is somewhat unorthodox; I left school with few qualifications and then worked for a number of years as a secretary. After successfully completing correspondence course 'A' Levels, I read for a BEd honours degree, followed by an MA in English Literature. After this, a PhD seemed the right thing to do, the result of which has been the publication of two books on modern American drama and numerous articles. Some



lecturing and a bit of academic administration led to my being employed as Head of Postgraduate Education at the Royal College of Psychiatrists in London.

However, after nine years in post, when I saw the advertisement for the Assistant Directorship of the Leverhulme Trust, I knew my days among the psychiatrists were numbered. When I then learned more about the Trust, its 'raison d'être' as a funding body, and that it often supported those without the financial means to maximise their potential and exploit their talent, there was never any doubt in my mind that this was the job for me.

The Leverhulme Trust was established in 1925 under the Will of the First Viscount Leverhulme with the instruction that its resources should be used to support 'scholarships for the purposes of research and education'. Since that time, the Trust has interpreted this in the broadest and most creative sense possible to ensure that its 'target audience' of outstandingly talented and creative individuals are reached. Lord Leverhulme placed great emphasis on the crucial role of the individual in advancing the well-being of the community.

Thus, the Trust seeks to support those who have a really good and original idea that is their 'personal vision'; perhaps it is genuinely 'blue skies' research, or it crosses disciplinary boundaries in a fresh and innovative way that does not fit well with the remit of other funding agencies. If the applicant's ability to carry out such a project is considered by the Trustees to be truly compelling, then Trust criteria would be satisfied. Talented (and often financially-challenged) young people able to demonstrate real potential in any area of the fine or performing arts are also encouraged by the Trust.

Through the varied portfolio of schemes we offer (including Study Abroad Studentships, Early Career Fellowships, Research Project Grants, Major Research Fellowships through to Emeritus Professorships), we try to meet the needs of academics at every stage of their career. Our prestigious and highly competitive Philip Leverhulme Prizes are aimed at researchers whose achievement has already earned them international recognition, but whose career is still at a stage where their greatest contribution to 'academe' may still lie ahead.

Two of the successful 2006 prize winners come from the University of Cambridge: Dr William O'Reilly from the Faculty of History; and Dr Rebecca Kilner from the Department of Zoology.

Dr O'Reilly is perhaps unique in combining two areas of research, one on Atlantic empires and the other on Central Europe. More importantly, he is trying to link these two areas with an original and exciting project in comparative history. Dr O'Reilly has published a number of articles on a very wide range of issues; his work is characterized by both intellectual ambition and a firm basis in archives, a combination as unusual as it is fruitful.

Dr Kilner has already made major contributions to our understanding of how parent-offspring relations are shaped by natural selection, and her work is widely recognised as providing important new insights into the evolution of signalling systems. She has carried out remarkable studies of the interactions between parent birds and their nestlings, demonstrating in particular the conflicts that both parties face in communicating and responding to needs in a way that balances costs and benefits.

Both prize winners represent perfect examples of what the Philip Leverhulme Prizes were set up to achieve. Our congratulations to them both.



THE LEVERHULME TRUST

**For more information about the Leverhulme Trust, please go to [www.leverhulme.ac.uk](http://www.leverhulme.ac.uk)**



*'My general area of interest is animal families. As 'societies in miniature', we use these as model systems to understand social evolution and the evolution of communication.*

*Within this broad area, most of my research has focused on birds. Thanks to the Philip Leverhulme Prize, I now have the opportunity to research a new system, insects. The Prize allows more scope for risk taking so I can expand into a new direction which traditional funding wouldn't allow.'*

Dr Rebecca Kilner,  
Department of Zoology

## The latest technology offerings available through Cambridge Enterprise Ltd

The Life Sciences team is responsible for the commercialisation of an enormous range of technologies from very early stage to advanced prototypes from both the University and Addenbrooke's Hospital. The range spans from novel configurations of lens in spectacles to alleviate presbyopia (in a functional form used daily by the inventor), through to clinical information systems for patient and data management, to more traditional areas of early stage leads for treatment of human disease and research technologies. We are currently seeing a particularly significant increase in the inventions in potential treatments of neurodegenerative disease and stem cell technology. Highlights are new strategies for treating neurodegenerative disease by the regulation of autophagy developed by Professor David Rubinsztein and important reagents for use in stem cell research.

**For more information about Life Science technologies, please contact [enquiries@enterprise.cam.ac.uk](mailto:enquiries@enterprise.cam.ac.uk)**

The Physical Sciences team covers a wide range of technologies from software to innovative materials, chemistry and electronics. Current available technologies include an improved thyristor device which has excellent turn-on characteristics and low on-state power dissipation. There is a great deal of interest in a novel coilable bistable structural sheet which could produce a foldable support for flexible electronic displays and portable media (see p7). Finally there is a new technology which enables printing electronic circuitry on to plastic substrates. Commercial partners are sought for these technologies and others in the portfolio.



Several spin-out companies have recently been formed around exciting technologies from the University. Encsys (above) is an example of a company for which the Cambridge Enterprise Seed Funds provided much needed early stage funding. Encsys ([www.ency.com](http://www.ency.com)) is developing new ways of connecting energy sources such as solar, wind and fuel cells to the electricity grid.

**For further information about Physical Science technologies, please contact [enquiries@enterprise.cam.ac.uk](mailto:enquiries@enterprise.cam.ac.uk)**



CAMBRIDGE ENTERPRISE LTD

## New structure for Cambridge Enterprise

**Cambridge Enterprise has been incorporated as a wholly owned subsidiary of the University and will now be known as Cambridge Enterprise Limited (CE Ltd).**

The new structure enhances financial transparency and operational focus on its mission to help University of Cambridge innovators make their ideas and concepts more commercially successful for the benefit of society, the UK economy, the inventors and the University.

Under the new structure, CE Ltd is governed by a Board of Directors and reports to the Research Policy Committee. The Board of Directors, appointed by the University, will interface with the University Finance Committee. The Board comprises members internal and external to the University and includes: Professor Chris Abell; Lord Roger Freeman; Professor Sir Richard Friend; Pro-Vice Chancellor Professor Ian Leslie; and Dr Nicola Nicholls. Ms Teri Willey as Chief Executive of CE Ltd and Dr Richard Jennings, as the CE Ltd appointee, will also serve on the Board.

The mandate for CE Ltd is to: aid the transfer of knowledge from the University via commercialisation; aid staff and students in making their ideas more commercially successful; and produce a financial return for inventors, Departments and the University.

To meet this mandate, CE Ltd's focus is to be a trusted business resource to University of Cambridge academics who are interested in distributing their ideas through commercial channels, and who are working on cases with significant potential for societal or financial impact. CE Ltd will work with these researchers to find an optimal route to commercialise their ideas via licensing to existing companies, spin-outs or consultancy.

There are three general types of business services available to the academics through CE Ltd.

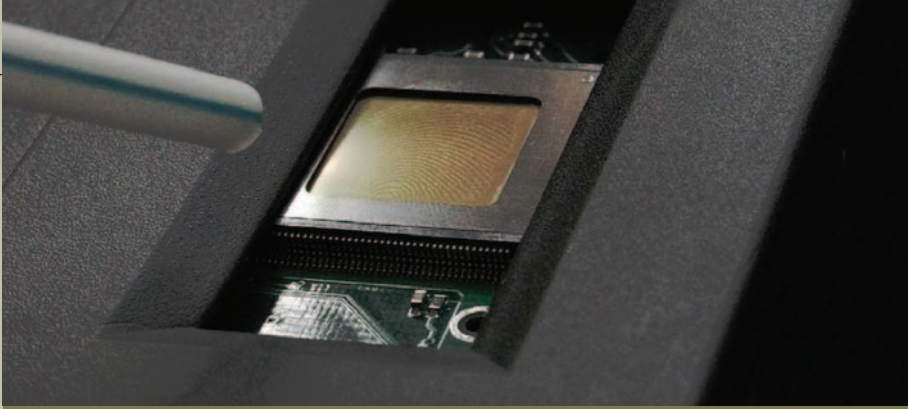
- i Consultancy Services:** Consultancy is an important activity through which the University can promote and support knowledge transfer, and create productive interactions with industry. The service comprises: all necessary support including negotiation of fees, terms and conditions, and assistance with costing and pricing; a standard contractual agreement which protects the consultants and University's interests appropriately plus formal arrangements for the use of University facilities; invoicing and accountancy services, professional indemnity and personal liability cover.
- ii Technology Transfer:** This is the core business of CE Ltd. The service includes: disclosure management and review to determine commercial potential and routes for using commercial channels to take an idea forward; patent strategy, filing and maintenance; proof-of-concept funding; research reagent, software and other tangible material distribution arrangements; identification of new or existing companies as potential commercial partners (licensees); license negotiations and maintenance of these commercialisation (license) agreements; licensing revenue management and distribution.
- iii New Venture Services:** Occasionally a licensee needs to be created to take an idea forward. CE Ltd can provide the following internally or through referrals and relationships with other organisations: business planning, mentoring, surgeries and related programmes; access to capital via the Cambridge Enterprise Seed funds; associated funds known as Cambridge Venture Partners; other venture organisations, and area angel investors.

Marketing at CE Ltd supports and accelerates the movement of cases from the disclosure stage to partnering or other investment through awareness-raising events, specialist forums, and outreach to technology focused organisations.

CE Ltd also promotes outreach to Departments. Enterprise Champions can be nominated by Departments to provide informal advice to Department members on interacting with business and commercialising research. The Champions meet at least once a term with CE Ltd to provide feedback on CE Ltd's services and performance.

**To view a list of current Enterprise Champions or find more information about Cambridge Enterprise Ltd, please go to [www.enterprise.cam.ac.uk/inventions/inventions.htm#champions](http://www.enterprise.cam.ac.uk/inventions/inventions.htm#champions)**





## 'Risk, Threat & Detection' Horizon Seminar

Iris recognition, face detection and the use of terahertz imaging to uncover concealed weapons were amongst the topics debated at a recent Horizon Seminar organised by Research Services Division (RSD) at the University of Cambridge.

'Risk, Threat & Detection' showcased research in security technology, providing a unique opportunity to discuss this topical and controversial subject with academics, policy-makers and industry leaders. A prestigious array of speakers and a stimulating subject attracted over 150 delegates to Cripps Court, Magdalene College.

Leading Cambridge scientists, including Professor Ross Anderson, Professor Stephen Elliott and Professor Sir Michael Pepper, outlined their research and visions for the future of UK security. 'Dealing with security issues in today's world is difficult and challenging,' explained Sir Michael. 'The University of Cambridge, with its expertise covering a vast range of science and technology, can make a hugely important contribution to providing solutions to these problems.'

The programme also included talks from prominent external speakers, including Ken Brigden, Director of the Ministry of Defence's Counter Terrorism Science and Technology Centre, and Alan Pratt, Director of the Home Office Scientific Development Branch.

The former head of MI6 and current Master of Pembroke College, Sir Richard Dearlove, closed the Seminar stating, 'This is exactly the sort of forum that should be conducted at this University...bringing together experience and expertise.' The Seminar was followed by a Christmas drinks reception which provided an opportunity to network over mulled wine.

Hosted by RSD, this event is part of the Horizon series which aims to showcase the cutting-edge research undertaken at the University. The next Horizon Seminar is 'A Sensory World: novel sensor technologies and applications' on 20 March 2007 at The Kaetsu Centre, New Hall.

**For information about the Horizon Seminar series and to book online, please go to [www.rsd.cam.ac.uk/events/horizon](http://www.rsd.cam.ac.uk/events/horizon) or email [horizon@rsd.cam.ac.uk](mailto:horizon@rsd.cam.ac.uk)**

## NEWS FROM RESEARCH SERVICES DIVISION

### RSD Drop-In Sessions

**There is no substitute for meeting the people you work with on a regular basis face-to-face and so throughout the autumn, Research Services Division (RSD) ran a series of informal drop-in sessions at various locations across the University.**

The sessions gave academics, research associates, administrators and finance managers an opportunity to meet their contacts at RSD and talk about the various stages in applying for and managing research funding. It also allowed the team at RSD an opportunity to introduce the Division's new initiatives, including the Pre Award, Post Award and Information Services, to the people at the front-line of the University's research activities. The sessions sparked some lively and productive interactions as attendees shared their views on current research funding processes and learned about the wide range of support services available in RSD.

We are currently setting dates for drop-in sessions for 2007. So... if you would like help to obtain funding for a research idea or in putting together a research grant application, are new to making applications, need help spending your grant or just want to know more about RSD in general, please come and see us!

**For more information, please contact Jo Ryan at [jo.ryan@rsd.cam.ac.uk](mailto:jo.ryan@rsd.cam.ac.uk) or on +44 (0)1223 765404.**



## Research Funding Roadshow

**Research Services Division (RSD) recently hosted a Research Funding Roadshow to provide Cambridge researchers with the opportunity to meet representatives from major funding organisations.**

The event (pictured left) provided a stimulating forum for research staff to interact with the University's main research sponsors and find out more information about potential funding opportunities.

During the day, the Economic and Social Research Council (ESRC) and the Engineering and Physical Sciences Research Council (EPSRC) each ran a workshop to provide advice specific to their funding schemes. RSD also presented 'top tips' on applying for funding at the end of each workshop.

The event, held at the University Centre, attracted an extensive range of research sponsors. The list included the Addenbrooke's NHS Trust, Arts and Humanities Research Council (AHRC), Biotechnology and Biological Sciences Research Council (BBSRC), British Council, Cancer Research UK, Department of Health (RD Direct), Department of Trade and Industry (DTI), EPSRC, ESRC, Isaac Newton Trust, Leverhulme Trust, Medical Research Council (MRC), National Science Foundation Europe, National Science Foundation USA, Natural Environment Research Council (NERC), Particle Physics and Astronomy Research Council (PPARC), Carbon Trust, Royal Society, UK Research Office, and Wellcome Trust.

With over 120 delegates, the Roadshow provided a valuable opportunity for sponsors and researchers to find out more about each other's work in an informal and relaxed setting. We would like to thank everyone who attended – we hope you found it useful.



## Forthcoming events: Save the dates!

**22 February 2007**

### Knowledge Transfer Partnership Event

Find out more about the benefits of the DTI's Knowledge Transfer Partnership scheme and meet potential academic and industry partners. Supported by Research Services Division, this event is to be held at the University Centre. For further information, please contact Michael Simmons at [m.p.simmons@dpmmms.cam.ac.uk](mailto:m.p.simmons@dpmmms.cam.ac.uk)



**12–25 March 2007**

### Cambridge Science Festival: 'The Big and the Small'

As part of National Science Week, the Cambridge Science Festival aims to encourage young people to study science, technology, engineering and maths subjects further at school and University; and to engage with the public of all ages on topics of scientific interest and concern. The Cambridge Science Festival is the UK's largest free science festival and offers a great opportunity for families to come and see scientific departments at the University opening their doors and running educational and fun events. For more information, please contact Nicola Buckley at [nicola.buckley@admin.cam.ac.uk](mailto:nicola.buckley@admin.cam.ac.uk). Alternatively all of the Festival events can be viewed on [www.cambridgescience.org](http://www.cambridgescience.org) from early February 2007.

**20 March 2007**

### Horizon Seminar – 'A Sensory World: novel sensor technologies and applications'

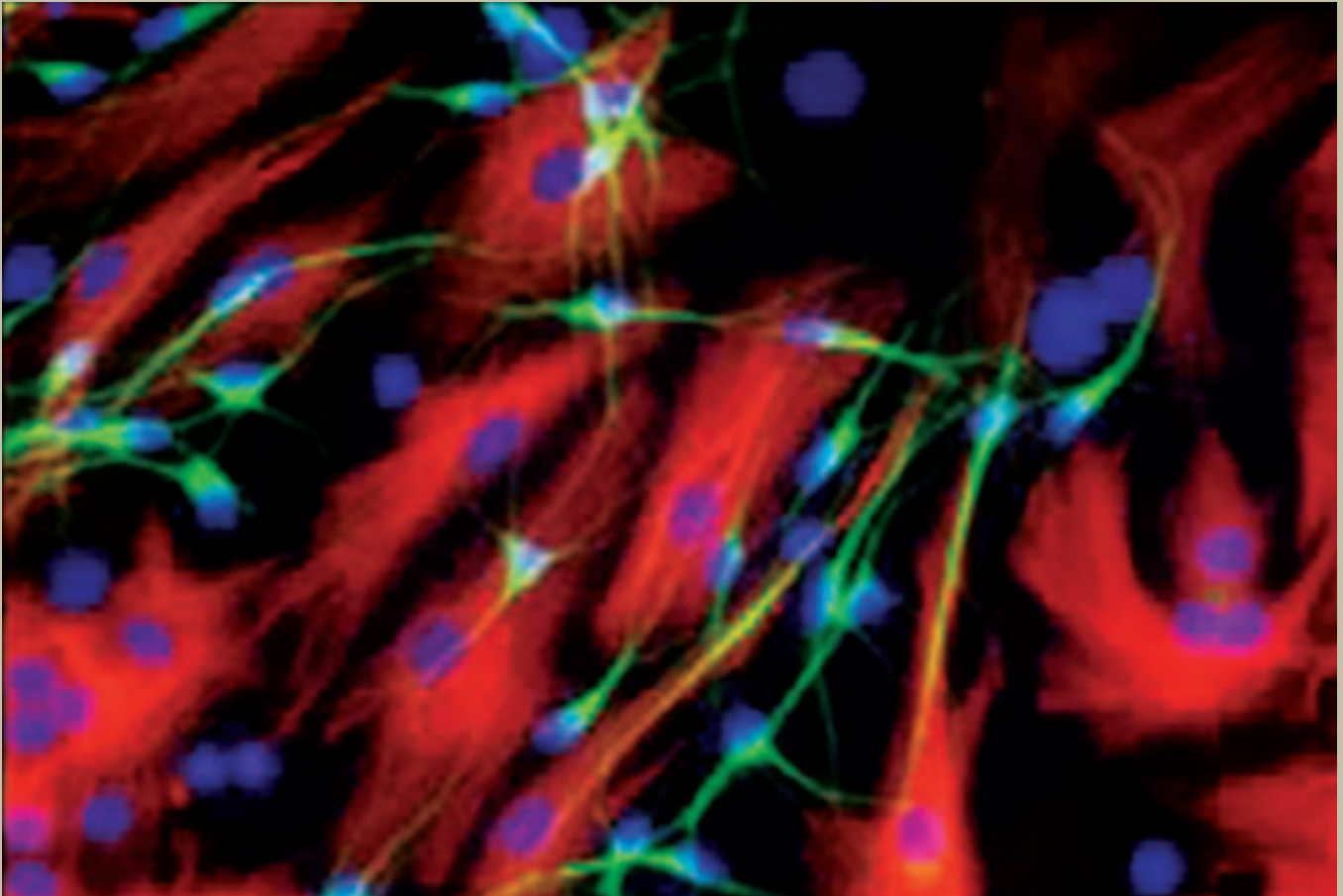
'A Sensory World' will showcase a broad selection of sensor technologies and systems that have been developed at Cambridge. The Seminar will cover a wide range of sensor perspectives from the basic technology and science of sensor design, applications for diverse situations and environmental conditions, and the challenges associated with rendering meaning from sensor networks or multiple heterogeneous sensing assets. Examples of cross-over and cutting-edge applications will be discussed by leading academics and experts from industry. The Seminar to be held at The Kaetsu Centre, New Hall, will provide delegates with a rich diversity of insights, perspectives and experiences.

**19 June 2007**

### Horizon Seminar – 'Foodomics? Why we Eat, What we Eat, and What's New on the Menu'

What motivates our choice of foods? What is the role of food in health related issues such as obesity? How will research into the science of food challenge our basic understanding of what we eat? These are just some of the questions that will be addressed by leading experts from a range of disciplines at June's Horizon Seminar to be held at the Centre for Mathematical Sciences, Cambridge. This Seminar will focus on four key areas of food related research: health; nutrition; food technology; and the environmental and social aspects of food. Full details will be announced in early 2007.





### 19–21 September 2007 Cambridge Neuroscience Launch Symposium

Cambridge Neuroscience is an exciting new initiative due to be launched with a prestigious international symposium. Cambridge Neuroscience will promote cross-cutting research across five thematic areas of neuroscience. The initiative aims to bring together neuroscience activities in Cambridge, and establish the University as a leading international centre of excellence for neuroscience research.

The Cambridge Neuroscience Launch Symposium will showcase the depth and breadth of neuroscience activity in Cambridge, with an outstanding line-up of local and international speakers. The symposium has been divided into five half-day sessions, each focusing on one of the five key themes of neuroscience research. Guest speakers will include Professor Antonio Aguzzi, Nobel-Prize winner Dr Linda Buck, Professor Antonio Damasio, Professor Tom Jessell, Professor Earl Miller, Professor Joshua Sanes, Dr Mike Shadlen and Dr Daniel Weinberger.

Registration for the symposium will open in early 2007. For more details about Cambridge Neuroscience, please contact the Cambridge Neuroscience Co-ordinator, Dr Danielle Turner at [dct23@cam.ac.uk](mailto:dct23@cam.ac.uk)

### 10 October 2007 Horizon Seminar – ‘Energy: What Does the Future Hold?’

Energy is essential to every aspect of our economic and social well-being. Today, the world faces two big challenges: climate change and security of energy supplies. To tackle the dual problems of the declining energy resources and the threat of climate change we need a mix of new technologies to generate ‘clean’ energy and an updated energy infrastructure that can cope with future demand. The Horizon Seminar entitled ‘Energy: What Does the Future Hold?’ will showcase latest research in energy technology and policy. Leading experts from a range of disciplines will address key issues and detail the latest scientific advances and new thinking in this field. This Seminar will be held at the Kaetsu Centre, New Hall.

### 4 December 2007 Horizon Seminar – ‘Live Long and Prosper? Ageing in the 21st Century’

Based on health improvements in the last century – due to hygiene, sanitation, engineering and the development of preventative treatments against infectious disease – many developed societies are experiencing increased longevity, and its consequences. In Europe, people older than 80 now represent the fastest-growing age demographic. In the next 25 years the ‘population pyramid’ may become a ‘population skyscraper’, as science moves into our cells to find new therapies, and design enables prolonged activity and independence in our living and working spaces. What effect will an ageing population have on the individual, the family, the state, society and economies worldwide? Are we creating a ‘demographic time bomb’, or are there opportunities to explore? Where are the answers to be found?

Hear the opinion of leading academics from Cambridge and beyond, at this Horizon Seminar to be held at the Centre for Mathematical Sciences, Cambridge.

Horizon Seminars are organised by Research Services Division. For more information and to book online, please go to [www.rsd.cam.ac.uk/events/horizon](http://www.rsd.cam.ac.uk/events/horizon) or email [horizon@rsd.cam.ac.uk](mailto:horizon@rsd.cam.ac.uk)

We are looking for article ideas for Issue 3 of Research Horizons and welcome suggestions from all areas of research across the University. The deadline for ideas is 27 February 2007. Please send submissions to the Editor at [Research.Horizons@rsd.cam.ac.uk](mailto:Research.Horizons@rsd.cam.ac.uk)

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## Your way into Cambridge

**Research Services Division (RSD) helps academics to identify, secure and manage research funding from external organisations.**

We identify funding opportunities through our relationships with regional, national and international sponsors and then support academics through every step of the awards process, from applying for a research grant and checking applications are correct, through negotiating contracts to protect the interests of academics and the University, to supporting Departments in managing funding throughout the life of a research project.

RSD also encourages collaboration between the University and industry, and fosters long-term research partnerships between sponsors and academics for mutual benefit.



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