

RESEARCH HORIZONS



In this issue
**HUNGRY FOR
KNOWLEDGE**
food research
plus news and views
from across the
University





Foreword

Hello and welcome to the third issue of Research Horizons – an edition with a distinctly nutritional feel to it as we

focus on ‘Foodomics’. We’ve coined this term for the next of our flagship Horizon Seminars, on 19 June, to bring together researchers working in very different fields – medicine, chemical engineering, social anthropology, archaeology, plant science – but all with the common link of food and nutrition. The Horizon Seminars continue to draw diverse audiences to Cambridge four times a year to experience a flavour of its cutting-edge research – we hope you can join us in June.

As ever, we also open doors on the incredible breadth of research across the University, through our News and Features sections. In this issue we bring you the psychology of gambling and who are Europe’s happiest people. We define the ideal clothes-buyer in today’s endeavours for sustainable living and we describe the dipstick test that is being used to diagnose diseases in resource-poor settings. We reveal the unfolding story behind the Austrian playwright Arthur Schnitzler, gleaned from the vast archive in the University Library of ‘hidden’ manuscripts rescued from the Nazi book-burnings. We go in search of poppies and crocus with the Cambridge University Botanic Garden. And we reflect on what the Islamic architecture of the great medieval palaces and mosques of Iberia and Morocco can tell us of the societies who built them.

We also continue our two regular features – ‘Inside Out’ and ‘In Focus’ – which give an insight into the world of academics and their sponsors.

Heartfelt thanks go to all our authors and contributors. We hope you enjoy this edition of Research Horizons and we look forward to any comments and ideas for future issues. Please email me at Research.Horizons@rsd.cam.ac.uk

Louise Walsh

Dr Louise Walsh
Editor



DR SADAF FAROOQI

Why are we so fat?



WELLCOME TRUST

Two worlds, same needs, one solution

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Your way into Cambridge

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Cambridge commits to conservation

New professorships in the University are spearheading major initiatives that are helping to build long-term programmes and partnerships in biodiversity conservation.



Professor Bill Adams (left), Moran Professor of Conservation and Development, and Professor William Sutherland, Miriam Rothschild Professor of Conservation Biology

Protecting the planet's natural resources and biological diversity for the future has become a matter of global concern. Human demands on the biosphere are growing as an inevitable part of the process of development, and biodiversity loss is an increasing issue. Recognising the urgency of these problems, the University of Cambridge is building a long-term programme in conservation. This will draw together expertise in both the natural and social sciences to work with international conservation organisations to address conservation.

At the heart of this commitment, donations totalling £5.8 million have endowed two new chairs that are now spearheading an important new phase of the University's developments in conservation.

Professor Bill Adams in the Department of Geography has been appointed as the first Moran Professor of Conservation and Development, generously endowed by James and Jane Wilson. Professor Adams has worked for many years in the University, carrying out research on the human dimension of conservation. He is interested in how social, economic and political factors affect the way natural resources are used and conserved.

In the School of Biological Sciences, Professor William Sutherland has been appointed to the Miriam Rothschild Professorship of Conservation Biology, established in the Department of Zoology following a generous donation by the Lisbet Rausing Charitable Fund. Professor Sutherland has particular interests in

predicting the impact of environmental change and in building the evidence base for effective conservation practice.

The Cambridge region is a unique centre of conservation research and action, with the headquarters of many internationally renowned research and conservation organisations – among them, the United Nations Environment Programme World Conservation Monitoring Centre, BirdLife International, the British Antarctic Survey, the Tropical Biology Association, the Royal Society for the Protection of Birds (RSPB), and Flora and Fauna International – as well as being the home of Anglia Ruskin University. The work of the University and these organisations is coordinated through the Cambridge Conservation Forum, which holds regular meetings. The University is now hoping to build on these relationships and the work of the Forum to make significant contributions to the global understanding and practice of conservation. This emphasis on collaboration is reflected in a new honorary professorship awarded to Professor Rhys Green in the Department of Zoology, who is a Principal Research Biologist in the Conservation Science Department at the RSPB.

Professor Sir Tom Blundell, Chair of the School of Biological Sciences, explains the importance of these appointments: 'Conservation of natural resources and biodiversity are key to sustainability. Cambridge is building on its academic strengths in these areas to make a real contribution to our future.'

Self-lubricating skis

Of all sports, downhill skiing is perhaps the one decided by the smallest of margins.



PROFESSOR PETER STYRING

PHOTOGRAPHER: DONI POLLARD

Testing at race speed

Often hundredths of a second can be the difference between first and fourth, and the jockeying for medals can be determined by the smallest of errors. Dr Alexander Routh in the Department of Chemical Engineering and BP Institute has been working with Professor Peter Styring at Sheffield University on improvements that shave off these valuable milliseconds.

Top athletes adopt tuck positions to minimise air resistance and wax their skis with proprietary formulations to minimise friction with snow. But the problem with wax applied in this way is that it wears off and so ski performance deteriorates throughout the race. From an engineering perspective, the wax is applied batch wise and a continuous application is far superior to this.

To optimise the continuous lubrication of skis and keep within regulations of the Fédération Internationale de Ski, Dr Routh and Professor Styring have developed a continuous ski lubrication system. A reservoir of fluid is located under the ski binding and this is pumped to the ski base through microfluidic channels. Trials of various lubricants have been undertaken on artificial ski matting, indoor artificial snow slopes and in the Austrian Alps. Speed increases of up to 50% have been observed on the artificial slopes and 3–4% on snow. These speed differences could move the leading British skiers into medal contention.

With such promising results, the inventors are now seeking commercialisation opportunities. Sheffield University has established Wildfire Snowsports to hold the intellectual property from the project and discussions are currently underway with ski manufacturers.

For more information, please contact Dr Alexander Routh (afr10@cam.ac.uk).

Monkey business

Ground-breaking discoveries by two Cambridge researchers have placed monkey behaviour closer to humans than had previously been thought. Dr Antonio Moura and Paco Bertolani, both in the Department of Biological Anthropology, have uncovered previously unseen behaviour that could have implications for understanding human evolution.

Dr Moura's research takes him to the Caatinga dry forest of the Serra da Capivara National park, in the Piauí state of north-east Brazil, where he documents the behaviour of capuchin monkeys. Capuchins use stones for digging and foraging. His recent observations show that they also use stones as a signalling device to ward off potential predators.

The discovery came when he noticed that on his approach the monkeys would search for a suitable loose stone before using it to hit the surface of a rock. The stone banging appears to be an aggressive reaction to the perceived presence of a predator. 'They would seem to be communicating the danger to one another at the same time,' explains Dr Moura.

Crucially, as Dr Moura could find no environmental influence for developing this skill, stone banging appears to be an acquired skill learned by observing and replicating one another – the first evidence of material culture in capuchin



Capuchin monkey

monkeys. 'The diverse tool technology of capuchin monkeys living in Caatinga suggests the payoff of social learning is higher in extreme habitats,' speculates Dr Moura.

A similar tale is unfolding in Fongoli, Senegal – a hot and dry area of savannah thought to be similar to the East-African Rift Valley paleo-environment where human evolution took place. Here, Paco Bertolani has discovered a group of chimpanzees fashioning spears from wooden sticks and using them to hunt small mammals. 'This is the first report of hunting with tools by non-humans. Traditionally, the hunting of vertebrates with tools was considered a uniquely human trait,' explains Paco Bertolani.

As with the capuchin monkeys, although the use of tools has previously been observed in chimpanzees, this new pattern of habitual tool use in a hunting context is the first report in non-human primates.



Chimpanzee

In a further twist to the tale, the spear-using chimpanzees were predominantly female and young. 'In modern chimpanzees, hunting was previously thought to be a male activity, in the same way it was assumed to be in extinct members of human lineage,' says Paco Bertolani.

What can these studies tell us about our human ancestors? Dr Moura's evidence that monkeys can learn skills from each other, in the same manner as humans, suggests an element of human-like culture in capuchins. Paco Bertolani speculates that the manufacture and use of spears may have arisen to exploit a different resource, perhaps echoing a similar step taken by our own ancestors.

For more information, please contact Dr Antonio Moura (moura_a@yahoo.com) and Paco Bertolani (mpb44@cam.ac.uk).

Towards safer nuclear waste storage

How adequate are Britain's plans for disposing nuclear waste?

Decommissioning of the UK's first generation of nuclear power stations and the prospect of their replacement has highlighted the challenge of how to dispose of the 'nuclear waste legacy' in a way that is equitable to future generations.

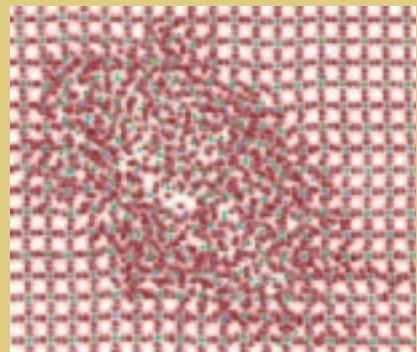
In July 2006, Britain announced plans to construct a repository for its nuclear waste stockpile – a volume of about 470,000 cubic metres incorporating 78 million terabecquerels of radioactivity – emplacing the material hundreds of metres beneath the Earth's surface.

Recent studies by a team from the University of Cambridge and the Pacific Northwest National Laboratory in the USA have begun to devise new ways to measure the effectiveness of storing radioactive waste in different crystal forms.

These tests, based on the use of nuclear magnetic resonance, allow researchers to identify and quantify areas of the mineral that have been damaged by radiation. The tests could be used to provide a quantitative assessment of materials used to store highly radioactive elements that would provide confidence in their performance thousands of years into the future. By then most of the radioactivity would have decayed.

'By working harder on the waste form before you started trying to engineer the repository or choose the site, you could make billions of pounds worth of savings and improve the overall safety,' said Cambridge Earth Scientist Dr Ian Farnan, who led the research. 'At the moment, we have very few methods of understanding

how materials behave over the extremely long timescales we are talking about. Our new research is a step towards that.'



Simulation of the effect of a radioactive decay event, showing how the atomic structure of a zircon is severely disrupted by internal radiation damage

For more information, please contact Dr Ian Farnan (ifarnan@esc.cam.ac.uk).

High-performance problem-solving

Computers already make an enormous impact on our quality of life by reducing the cost of developing new products and enhancing their safety. According to Moore's Law, the performance of computers doubles every 18 months. Despite this, many scientific problems are still too complicated to be solved on standard computers and new approaches are needed.

One approach is to link many computer processors together into a so-called parallel computer, with processors attacking the problem simultaneously. These can now be built cheaply by using standard commodity components, even those used in your home PC.

A new acquisition by the University – a Dell computer named Darwin comprising 1170 dual core Intel processors connected by InfiniBand interconnect – is the fastest academic computer in the UK and the 20th fastest computer in the world (www.top500.org/list/2006/11/100). By exploiting the commodity model, it offers significantly higher performance per unit cost than comparable systems.

Many problems can be split into parts and processed independently on separate computers around the world, and the

results combined. For such problems, Grid Computing is a good alternative to parallel systems. In Cambridge, nine departments together with the University of Cambridge Computing Service (UCS) have created CamGrid, a linked system of over 700 processors shared by the participating researchers. This ensures that spare capacity in one department can be used by others. The largest such computational grid is being deployed for the Large Hadron Collider, the world's most powerful particle accelerator. Over 100,000 computers will be harnessed to analyse the data, expected to amount to several petabytes each year, stored on disk farms around the world (www.cern.ch).

However, computers are only part of the story. We also need powerful and efficient numerical algorithms and software to exploit these systems. Many

case studies have shown that improvements in computational techniques generate performance speeds faster than predicted by Moore's Law. One bottleneck is the enormous volume of data generated by modern science, for which new techniques are required to store and analyse it.

The University has a long tradition of developing computational techniques. In the past, computational scientists tended to be self-taught. This is no longer so true and there are fewer students with experience of writing software. The University is responding to this challenge by creating a Master's course in Scientific Computation. The aim is to train the next generation of scientists in modern software engineering techniques and provide them with access to world-class computational facilities. They will then be equipped to take up challenges such as designing new materials and better drugs, and providing earlier diagnosis of illness.

For more information, please contact Professor Mike Payne (mcp1@cam.ac.uk) and Professor Andy Parker (parker@hep.phy.cam.ac.uk).

Nanotube formation captured on video

A team of scientists at the University of Cambridge have succeeded in producing live video footage that shows how carbon nanotubes form.

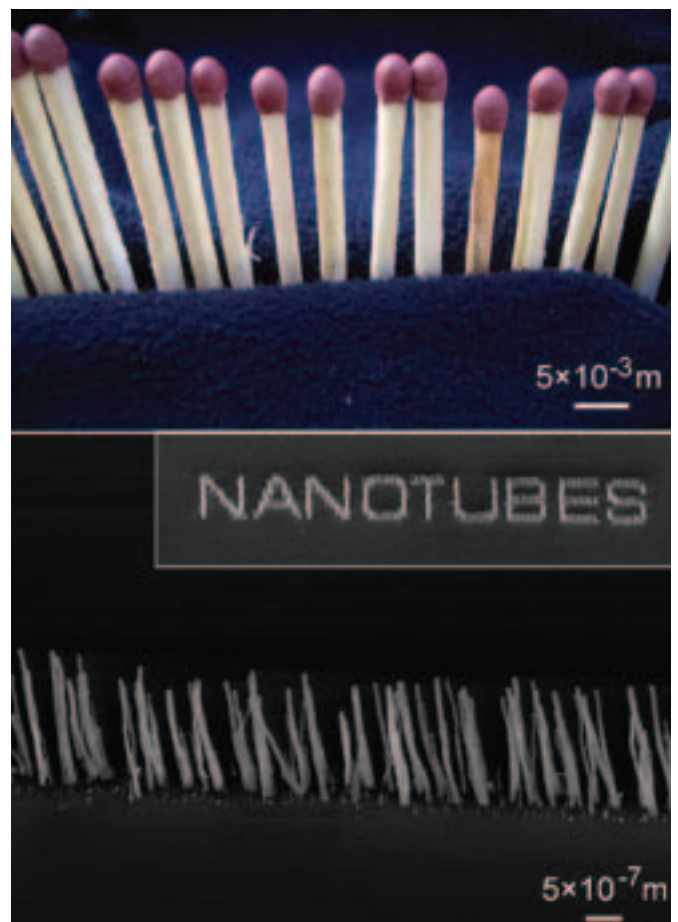
The video sequences, demonstrating nanofibres and nanotubes nucleating around miniscule particles of nickel, take place in real time on an astonishingly small scale. Nanotubes are more than 10,000 times smaller in diameter than a human hair.

The microscopic scale involved has previously made it difficult to understand the growth process, and the videos are already offering greater insight into how these microscopic structures self-assemble. Carbon nanotubes are new building blocks enabling engineers to improve and further miniaturise everyday electronic devices like computers or mobile phones.

Currently, scientists can grow nanotubes but cannot accurately control their structure. Being able to do so is vital as it is the structure of a nanotube that dictates its properties. The nano-scale video observations mean that scientists will be able to understand the nucleation of nanotubes and are therefore an important step towards application.

'In order to reach the full application potential for nanotubes,' explained Dr Stephan Hofmann, who led the research, 'we need to be able to accurately control their growth first. As a manifestation of the impressive progress of nanometrology, we are actually now able to watch molecular objects grow. This new video footage shows that the catalyst itself remains crystalline but is constantly changing its shape as the carbon network is formed around it.'

The video sequences can be viewed on the University News and Events website at www.admin.cam.ac.uk/news/special/20070301; the original article was published in *Nano Letters*.



Size scale of nanotubes compared with matches

For more information, please contact Dr Stephan Hofmann (sh315@eng.cam.ac.uk) or go to his website (www-g.eng.cam.ac.uk/edm/people/sh315.html).

Polar science: IPY and SPRI

The largest coordinated programme of international polar activities in 50 years – International Polar Year (IPY) – kicked off globally on 1 March 2007. Building on a 125-year history of previous polar events in 1882–1883, 1932–1933 and 1957–1958, the aim of IPY is to promote even greater international scientific collaboration to address issues of global importance within the Arctic and Antarctic.



DR IAN WILLIS

As well as seeking to make major advances in polar knowledge, a key theme is to leave a lasting legacy of polar data that will be of scientific and educational value for the future. All polar years have provided snapshots of the state of the polar regions at that time, giving us a baseline for past, present and future changes to be monitored and predicted. Each of the 200-plus international projects beginning this year is also committed to demonstrating cutting-edge science in real-time to schools and communities around the world.

This element of outreach is viewed by Professor Julian Dowdeswell, Director of the Scott Polar Research Institute (SPRI) in Cambridge, as vitally important for public engagement with polar science: 'The international outreach component of each project is designed to present the polar regions in general and key IPY science issues in particular to people throughout the world.'

For SPRI, the impetus provided by IPY has strengthened and formalised links with other researchers in the UK and worldwide. Already internationally recognised for its work in geophysical, environmental and social sciences, SPRI has several activities that will take place during IPY.

SPRI projects are wide-ranging: from assessing the social, economic and cultural significance of Arctic reindeer and caribou hunting, to measuring and modelling changes to glaciers. Dr Ian Willis, studying the mass balance of glaciers in Svalbard and Iceland, stresses the importance of combining field-based, airborne and satellite remote sensing data to assess the current state of glaciers at the beginning of the 21st century. He adds, 'Computer modelling can then link climate and the mass balance of glaciers in the past and be used to predict changes for the next 100 years – something that is of considerable significance to discussions of the effects of global warming on changes in sea-level.'

Professor Dowdeswell explains the importance of IPY: 'The IPY should be a time for everyone to learn and reflect on regions of our world which few have visited but which are essential to the future well-being of all of us.'

For further information, please go to the IPY website (www.ipy.org) and the SPRI website (www.spri.cam.ac.uk).

Digitising the polar legacy

A full digital record of all archived materials from past International Polar Year (IPY) events is being collated by the National Snow and Ice Data Center (NSIDC) in Colorado, USA.



SCOTT POLAR RESEARCH INSTITUTE

Equipped for a cold spell of auroral photography; image from the 1932–1933 IPY

The Scott Polar Research Institute (SPRI), like other polar libraries from around the world, is contributing to this huge collection of materials, many of them rare and previously available only in specialist repositories.

The end-point will be a vast online bibliography with links to full text that will be available for generations to come. The capture and recording of this material will be ongoing throughout the current IPY and beyond.

For SPRI, which holds considerable material from the 1932–1933 IPY and from the 1957–1958 International Geophysical Year, this call for material ties into a wider project. With funding from the Joint Information Systems Committee (JISC), these digital records will also provide context for the Institute's historic photographs, which will be made available through an educational web-based resource 'Discovering the Poles, 1845–1960'.

Heather Lane, SPRI's Librarian and coordinator of SPRI's contribution to the digital record, describes the significance of this process: 'IPY has provided the catalyst for an activity that will be of great educational benefit for years to come.'

'The Big and the Small' – Cambridge Science Festival 2007

An estimated 20,000 people, from toddlers upwards, took part in the recent Cambridge Science Festival, which comprised more than 100 events across 40 departments in over three weeks.



PHOTOGRAPHER: NIGEL LUCKHURST

'Around 10,000 people came to the first of the two Science on Saturdays with huge numbers coming to the events on the West Cambridge Site on the second Saturday,' said Cambridge Science Festival Co-ordinator, Nicola Buckley.

'There has been a marked upturn in numbers of teenage visitors, which is very encouraging as one of our aims is to inspire more young people to continue with science beyond GCSE and consider careers in science.'

For families, the highlights ranged from opportunities for budding scientists to extract DNA from kiwi fruit to the chance to build their own crane with the help of an undergraduate engineer.

Many of the ticketed events were booked up well in advance. Among the most popular were sessions on 'Emulsions and Foams: Making Ice Cream' run by the Department of Materials Science and Metallurgy.

Chemistry lecturer Dr Peter Wothers gave his talk 'It's a Gas!' (featuring the fabled rice crispie explosion) six times in three days to a total audience of 3000, with many people queuing for returned tickets.

In the Science Festival Roadshow, 20 academics gave talks at 48 different schools to pupils aged from four to 18. And for the first time, the Science Festival programme included Science Master Classes for schools, given by leading academics, which were attended by around 400 pupils.

For more information on this annual festival, please go to the Cambridge Science Festival website (www.cambridgescience.org).

New media to reach the masses

A new dimension to the Cambridge Science Festival this year has been the arrival of the podcast.



Lucy Capewell shooting the play 'Re:Design. A dramatisation of the correspondence between Charles Darwin and Asa Gray' for podcasting at the Cambridge Science Festival

Podcasting refers to media files that are distributed over the internet for downloading, which saves the file onto your computer, or for streaming, which displays the file while it is being delivered.

Six videos of 5–8 minutes in length presented by Carol Vorderman can be streamed or downloaded from the Science Festival website (www.cambridgescience.org). They give a flavour of the many wacky, fun and educational topics that were on offer at the festival – whether it is the dramatisation of Darwin's correspondence or the first flight of a scale model pterosaur wing.

The podcasts were made by Cambridge Media, a joint venture between the Office of Communications and the Centre for Applied Research in Educational Technologies, with collaboration from Apple. With 10,000 downloads and streams logged in the first 10 days, the podcasts have been a resounding success.

Lucy Capewell, the new Head of Cambridge Media, arrived in Cambridge in October 2006 with 20 years experience in documentary television. She executive produced the films and explains why we are more than ready to receive information in this medium: 'New media has moved out of the margins and into the main stream. Traditionally we've received our media through TV, radio and paper but audiences are now migrating to the net in favour of new media.'

With this paradigm shift in communications comes new opportunities. UC Berkeley had 17.1 million streams and downloads last year (<http://webcast.berkeley.edu/index.php>). 'New media can be delivered to a mass, niche audience and the institution can control the message. Universities are a good example of where world-class research and education can be married with award-winning TV documentary skills to deliver a range of content,' explains Lucy. 'In the future, we will see major institutions becoming their own broadcaster.'

The podcasts can be downloaded or streamed from the Cambridge Science Festival website (www.cambridgescience.org) or by subscribing to iTunes podcasts/science and medicine/Cambridge Science Festival.

For more information on Cambridge Media, please contact Lucy Capewell (lucy.capewell@admin.cam.ac.uk).

Nokia and nanotechnology in Cambridge

Nokia, world-leader in mobile communications, and the University of Cambridge have signed an agreement to work together on an extensive and long-term programme of joint research projects. Nokia Research Center (NRC), to be based at the West Cambridge Site, will collaborate with several departments – the Nanoscience Centre and the Electrical Division of Engineering to begin with – initially on nanotechnology projects.

Commenting on the agreement, Professor Ian Leslie, Pro-Vice-Chancellor for Research at the University, said: 'This collaboration both recognises and enhances Cambridge's global reputation for excellence in science and technology research. One of the greatest advantages to the University is the opportunity to work closely with a recognised worldwide leader in technology products and applications on 'real world' challenges and initiatives.'

For further information, please go to www.research.nokia.com

Foodomics? Why we eat, what we eat, and what's next on the menu

The Horizon Seminar 'Foodomics? Why we eat, what we eat, and what's next on the menu' will showcase the latest Cambridge research on the way we look at the complex issues regarding food and nutrition. The Seminar takes place on 19 June 2007 at the Centre for Mathematical Sciences, Cambridge.

Diet and nutrition are a global obsession. The effect of food on health is well documented but still dietary factors are associated with several of the leading causes of death in western society, (including heart disease, cancer and diabetes). Meanwhile the crisis of hunger and malnutrition in the developing world shows no sign of abating.

So how are food habits formed and how can we ensure we make smart food choices? How can we improve the nutritional value of foods while addressing problems of food allergies and sensitivities? How can we solve existing problems associated with poor nutrition, and anticipate and respond to emerging health issues? How will basic and applied research into the science of food challenge our understanding of what we eat and how we prepare it? What future advances can we expect?

For more information about the Horizon Seminar series and to book online, please go to www.rsd.cam.ac.uk/events/horizon or email horizon@rsd.cam.ac.uk

FOOD AND HEALTH

When selecting our food we need to balance convenience, nutrition and taste, as well as food miles and processing. Presentations will examine the effect of food on our health, showing how diet, lifestyle and genetics all play a part in both the problem and the solution.

Dr Susan Jebb

MRC Collaborative Centre for Human Nutrition Research

Professor Nick Wareham

MRC Epidemiology Unit

Dr Sadaf Farooqi

Dept of Clinical Biochemistry

Dr Ken Ong

MRC Epidemiology Unit

FOOD AND HUMAN BEHAVIOUR

Humans treat food in a very different way in comparison with other animals. When did our strange non-animal-like behaviour with food begin? Why do we choose certain items and what does this say about us?

Dr Manpreet Janeja

Dept of Social Anthropology

Professor Martin Jones

Dept of Archaeology

Dr Tamsin O'Connell

Dept of Archaeology

NUTRIENTS IN OUR FOOD

Everyone knows we need a balanced diet, but what does that actually mean? How can we increase the nutritional value of our raw ingredients and what effect is this all having on our health?

Professor Jonathan Powell

MRC Collaborative Centre for Human Nutrition Research

Professor Sheila Bingham

MRC Centre for Nutritional Epidemiology in Cancer Prevention and Survival

Dr Alison Smith

Dept of Plant Sciences

WHATS NEW ON THE MENU?

From new developments in process technology to food safety and provenance issues: we'll examine how new technology is challenging the food industry.

Dr Ian Wilson

Dept of Chemical Engineering

Professor Jim Murray

Institute of Biotechnology

Professor Duncan Maskell

Dept of Veterinary Medicine

Medical Research Council human nutrition research

Unravelling the complex interactions between the food we eat, our genetic make-up and the environment around us is important for addressing key public health issues. Research at the Medical Research Council (MRC) Collaborative Centre for Human Nutrition Research (HNR) aims to do just this – by combining observational population-based studies and controlled dietary intervention with mechanistic research at the physiological, metabolic, cellular and genomic levels.

HNR's role is to advance knowledge of the relationships between human nutrition and health. It was established in 1998 in the Elsie Widdowson laboratory in Cambridge and is now home to over 80 scientists and support staff. Its research portfolio reflects the philosophy of Dr Widdowson, herself an eminent nutrition scientist, of an integrated 'molecules to man' approach to nutrition science.

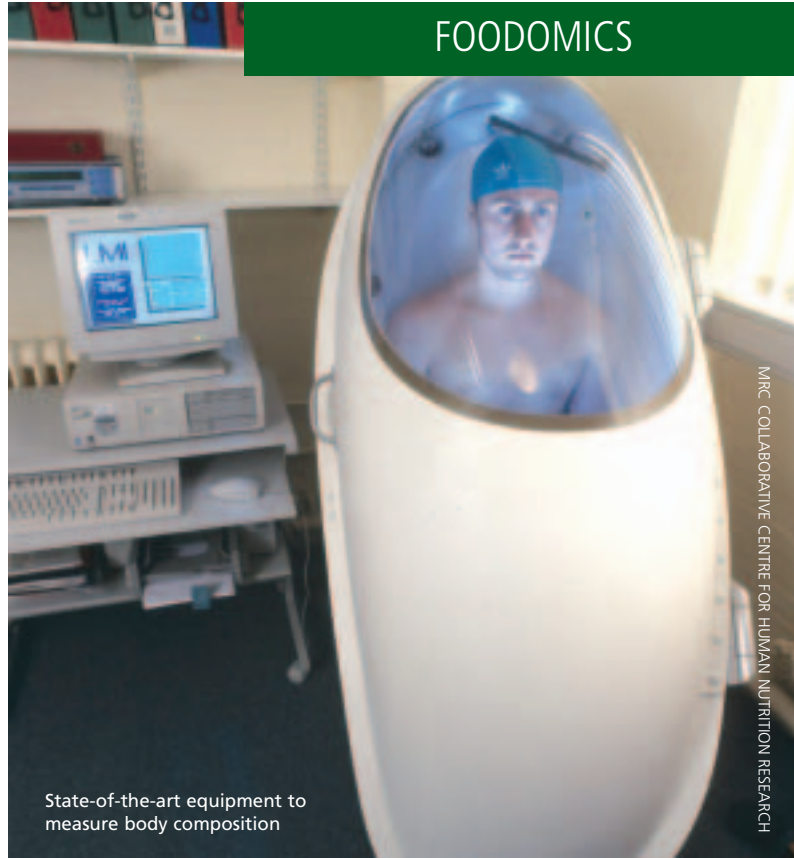
There is a strong collaborative ethos at HNR, both within and externally with national and international stakeholders in nutrition. The sharing of scientific expertise and resources maximises the opportunities for high-quality nutrition research. Accordingly, it has grown into a national centre of excellence in the measurement and interpretation of indices of nutritional status, as well as the development of innovative methodologies.

Research initiatives

Under the Directorship of Dr Ann Prentice, HNR has five integrated research sections:

- Population Nutrition Research – investigating diet and health through assessing dietary habits and their relationships to biomarkers and disease.
- Nutrition and Health Research – studying the role of diet in the prevention and treatment of obesity and related metabolic diseases.
- Nutrition and Bone Health Research – looking at nutrition and lifestyle factors that might optimise peak bone mass and reduce the risk of osteoporosis.
- Micronutrient Status Research – studying uptake, distribution, cellular handling and function of vitamins and minerals.
- Bioanalytical Sciences – developing innovative technologies to measure physiological processes such as lactation, insulin resistance, energy expenditure and bioavailability of nutrients in food.

A major programme of work is the National Diet and Nutrition Survey, conducted in collaboration with the National Centre for Social Research and on behalf of the Food Standards Agency. Each year, food intake, blood samples and physical activity levels are measured in each of the 1000 participants with the aim of identifying groups at risk of nutrient deficiencies.



State-of-the-art equipment to measure body composition

MRC COLLABORATIVE CENTRE FOR HUMAN NUTRITION RESEARCH

The programme provides a measure of progress towards the Government's targets for diet and activity as a nation: to halt the year-on-year rise in obesity among children under 11 years by 2010; to reduce the intake of salt to no more than 6 g per day; and to increase the proportion of adults who participate in 30 minutes of moderate physical activity five or more times a week to 70% by 2020.

At a local level, volunteers are recruited from Cambridgeshire to take part in studies that assess the impact of changes in dietary habits. Recent studies have shown the benefits of consuming oily fish and choosing foods with low glycaemic index or wholegrains on the risk of obesity-related diseases such as diabetes and cardiovascular disease. Other studies are addressing the impact of dietary habits on bone health and developing new treatments for iron-deficient anaemia. HNR has a dedicated communications team who promote the translation of nutrition science into policy and practice.

Links with the University

HNR is linked to the University of Cambridge through the postgraduate training programme, which has been developed to foster and maintain a high quality training environment for postgraduate students. The development of the new cadre of university centres, funded by the MRC, has increased the interactions between the two institutions.

For more information about the work of the unit, or to become a volunteer for one of the nutrition research studies, please contact the authors Holly Margerison and Claire MacEvilly in the Communications Team at HNR on 01223 426356 or go to www.mrc-hnr.cam.ac.uk

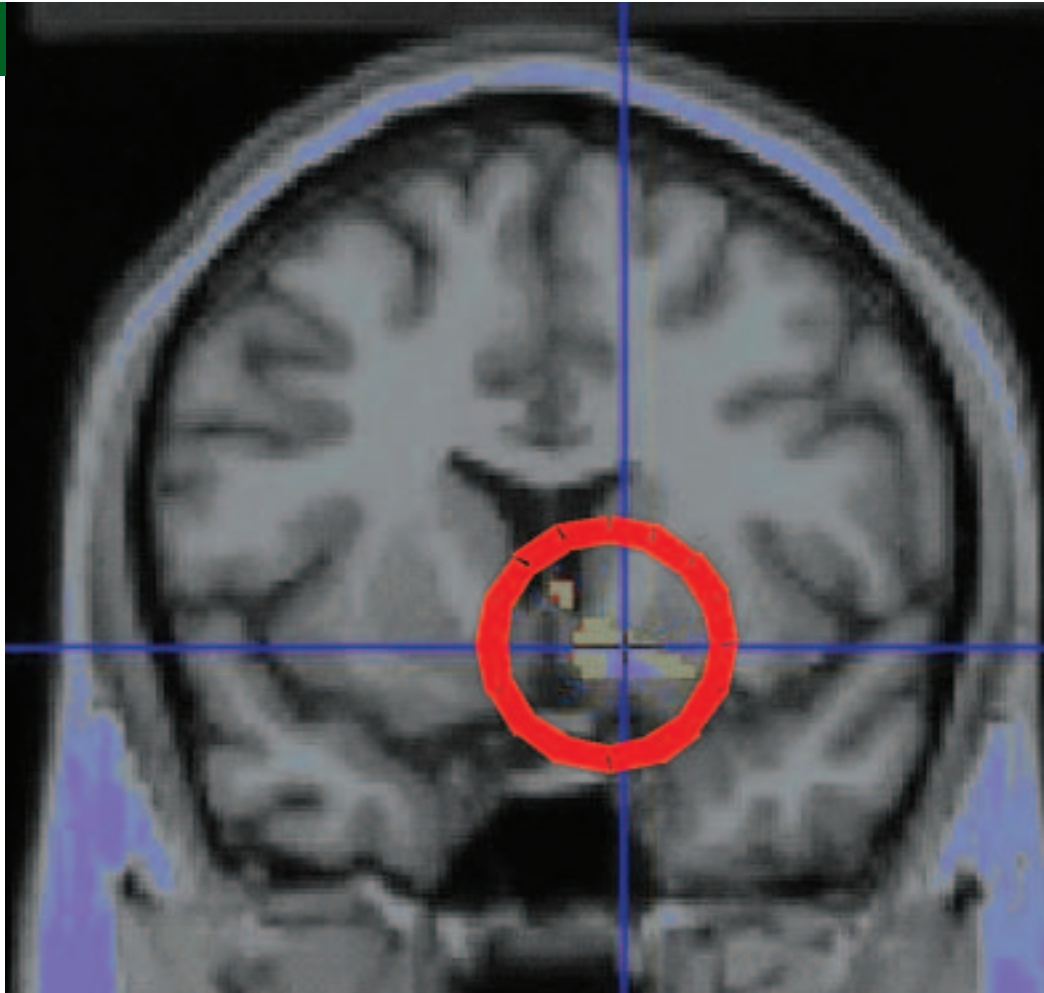


Holly Margerison



Claire MacEvilly

For some people, the urge to eat is uncontrollable. Cambridge scientists have taken us a step closer to understanding the causes of obesity by studying a group of patients for whom overeating is an everyday event.



Why are we so fat?

One of the most important public health issues of today is obesity. Why do people gain weight? Is it simply about eating too much food and taking too little exercise? Why do some people gain a lot of weight while others stay thin yet share the same environment? Dr Sadaf Farooqi, working with Professor Stephen O'Rahilly in the University Department of Clinical Biochemistry, is helping to answer some of these questions.

Obesity is defined as an excess of body fat that's large enough to result in adverse consequences for health – the most common being high blood pressure, type 2 diabetes, coronary heart disease and certain cancers. Although calculating exactly how much body fat a person has requires sophisticated techniques, we usually use body mass index or BMI (weight in kilograms/height in metres squared) as a measure of heaviness as it correlates reasonably well with body fat content. Obesity is defined as a BMI greater than 30 kg/m².

In the UK, current estimates of obesity indicate that 23% of men and 24% of women are obese (www.IOTF.org). The World Health Organization has warned that obesity has reached epidemic proportions globally, with more than 1 billion adults overweight and is now 'a major contributor to the global burden of chronic disease and disability.'

Why is obesity on the increase? We live in an age of increased availability of palatable, energy-dense foods and yet we have a reduced requirement for physical exertion during our working and domestic life. All this contributes to a state of positive energy balance, which over a period of time is enough to shift the mean BMI of a population. Obesity can run in families, which might point to the sharing of a common lifestyle but might also point to a genetic link. In fact, the heritability of body weight and fat mass is very high, at 40–70%, based on studies in twins and adopted children. How can we find the genes that control body weight?

Finding the 'fat' genes

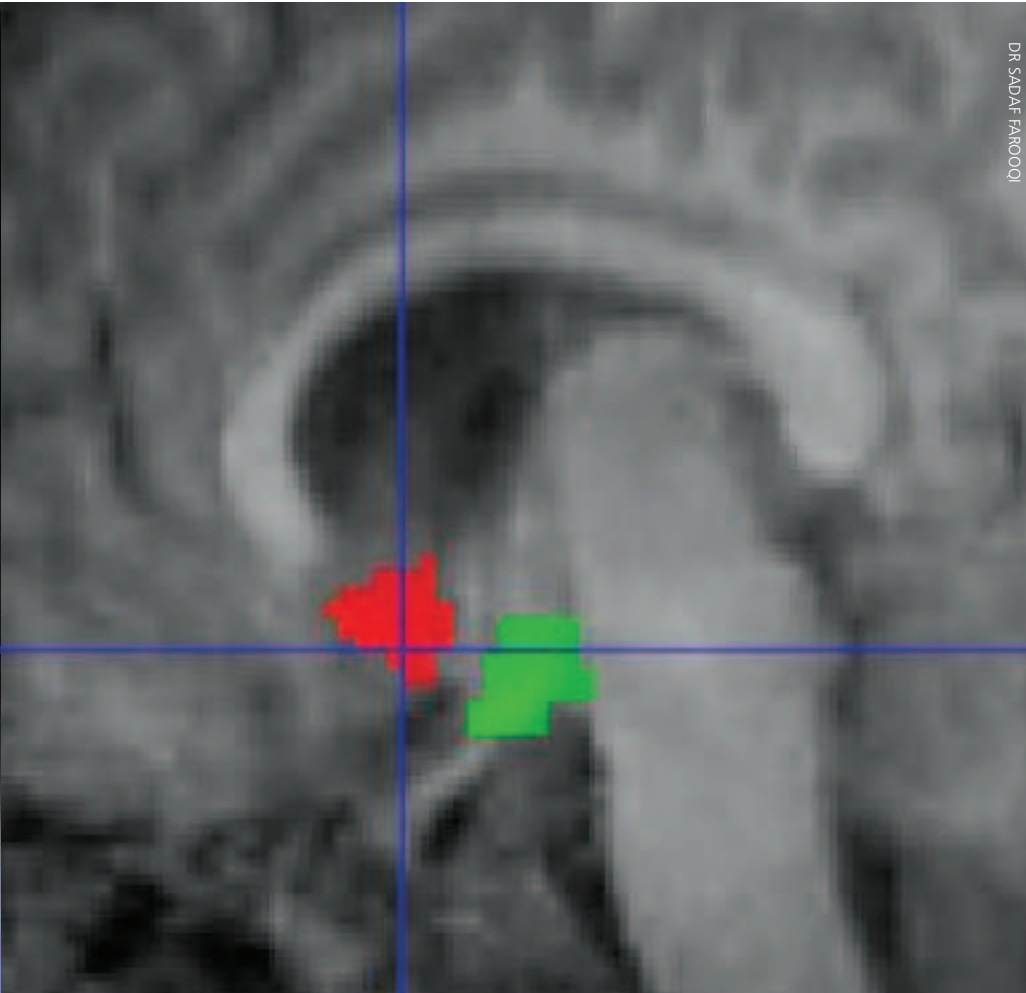
Dr Sadaf Farooqi and her colleagues have made progress in uncovering the molecular basis of obesity by focusing on patients who have severe forms of the condition. Many of the patients they study are extremely obese from a young age, with excessive food consumption beyond what is needed for their basic energy requirements – a type of behaviour known as hyperphagia.

The story began a decade ago, with the finding of two severely obese Pakistani cousins with uncontrollable appetites. Dr Farooqi's studies revealed that the children had undetectable levels

of a protein called leptin in their serum and further analysis showed that they carried homozygous mutations in the leptin gene. The story unfolded as other families were identified with mutations either in this gene or in the receptor that binds leptin. When the patients were given daily injections of synthetic leptin in a clinical trial, dramatic beneficial effects were seen: within two weeks, the uncontrollable food-seeking behaviour had normalised, and their body weight and fat mass slowly reduced to normal levels.

To date, the team have identified seven genes that, when defective, result in severe obesity in children. All are part of the leptin–melanocortin system and all are involved in the control of appetite. One of these, the gene encoding the melanocortin receptor MC4R, is turning out to be the commonest single gene disorder causing obesity, with mutations found in 0.1% of the general population, a prevalence higher than for cystic fibrosis. Dr Farooqi and colleagues have studied 2000 severely obese individuals as part of the Genetics of Obesity Study (GOOS), discovering that as many as 5–6% of participants have pathogenic mutations in this gene.

Unfortunately no therapy yet exists for patients with MC4R deficiency, although much has been learnt about



Dr Sadaf Farooqi

Functional MRI scan showing that the hypothalamus and reward centres are activated after a meal

how mutations change the structure and function of the receptor and also about the range of associated clinical problems. By studying over 150 patients with MC4R deficiency, Dr Farooqi and colleagues have shown that when MC4R doesn't work at all, this leads to a more severe form of the disease. This is even reflected in the amount of food eaten. People with a defective MC4R eat much more when given free access to food at a test meal, compared with people in whom the MC4R gene is working at 50%. This shows that MC4R acts as a brake on food intake and suggests that targeting MC4R may be useful as a treatment for obesity.

It's all in the mind

Eating behaviour results from the innate drive to eat. Although this is genetically determined, it's also influenced by the hedonic or rewarding properties of food – which can override the biological cues that govern hunger and fullness and result in hyperphagia. Eating behaviour is unique in that some of the key molecular determinants of the drive to eat are being identified. The genetic disorders involving the leptin–melanocortin pathway studied by Dr Farooqi affect a signalling pathway that starts with leptin released from fat cells and leads back to the hypothalamus in the brain. Studies in

patients with defects in the proteins involved in this pathway should provide the opportunity to find out how the biological pathways link with the reward pathways to influence eating behaviour.

The drive to eat: what's next?

Progress towards defining the molecular basis of obesity in some patients has helped not only to suggest treatment strategies but also to highlight that, for many people, theirs is a medical condition. The seven disorders found so far are likely to be joined by the identification of many other gene defects that lead to severe obesity. These findings provide insights into the pathways that regulate body weight, which in turn is a starting point for developing treatments that may well be applicable to more common forms of obesity.

Although several groups in the UK have recently identified the first gene, FTO, that increases the risk of common obesity in the population, uncovering the basis of common forms of obesity or more subtle genetic defects will undoubtedly prove harder, and new approaches to assessing obesity are an attractive option. One new avenue of research has been to look directly at what is happening in the brain in response to food. Considerable

experience exists in Cambridge in the use of imaging techniques to study brain function and to assess human behaviour in conjunction with biological correlates. Recent advances in these technologies are helping scientists to understand the brain pathways involved in eating behaviour. Dr Farooqi is working with Dr Paul Fletcher in the Department of Psychiatry and Drs Andrew Lawrence and Andy Calder at the Medical Research Council (MRC) Cognition and Brain Sciences Unit on one such technique. They are using functional magnetic resonance imaging (fMRI) to measure patterns of brain activity when people see images of food compared with everyday items such as toys, trees and trains. It is hoped that these studies will shed light on the areas of the brain involved in food reward and explain why some people have uncontrollable urges to eat.

For more information, please contact the author Dr Sadaf Farooqi (isf20@cam.ac.uk) at the Department of Clinical Biochemistry. This research is supported by the Wellcome Trust and the MRC, and the functional imaging studies are supported by an endowment from the WOCO Foundation.



Tamsin O'Connell (right) with Czech colleagues selecting mammoth bones for isotopic sampling

A strange way to share food

Imagine a small circle of great apes looking each other in the eye from a distance of less than a metre. They are making a fair bit of noise and showing their teeth. Between them are some items of food. It all sounds pretty nasty – encounters of this kind can get bloody and lethal. In this instance, however, the mood is quite different, it is convivial. We are observing one particular species of ape that has done something very odd with these age-old signals of threat and hostility. It has turned them on their head, moulding them into a pattern of behaviour repeated daily throughout their lives. We are looking at a human meal.

For many animals, eating is a reasonably solitary activity, and a rather continuous one that absorbs a significant portion of the day. Our meals by contrast

are discrete events that punctuate the day, and are social rather than solitary. Even when we do eat alone, we do our best to invent a social discourse in a virtual world, by opening a book, a newspaper, or tuning in a radio or TV. How did this unusual and unique behaviour come about, and what is it for?

As an archaeologist, that is a question Professor Martin Jones in the Department of Archaeology asks by looking back in time, by seeking out its origins. It's no straightforward task, as it involves tracking down transitory events, which by their nature involve biodegradable materials. Nonetheless, the methods we have available to detect the remains of ancient food have grown dramatically in recent decades.

Close scrutiny of the ancient remains of our ancestors' meals gives us some sense of the development and rationale behind our strange food-sharing behaviour.

Meals under the microscope

We are now able to recover in sieves very small pieces of animal and plant food, so as to discern food remains under the high-power microscope even after they have been dispersed into cellular and sub-cellular fragments. New advances in science mean we can even detect molecular traces in miniscule quantities.

It's now possible to analyse 'last meals' within the guts of well-preserved bodies, their fossil faeces in latrines, and isotopic signatures of dietary history in various parts of the preserved skeleton. If we are lucky, these various fragments can be trapped quickly by fast-accumulating sediments, such as coastal muds or wind-blown silts. When this happens, we may even be able to track the 'choreography' of the food quest, and estimate how many people came together and in what way around their meal. Through looking closely at a series of such ancient meals, some sense of the development and rationale of our strange food-sharing behaviour comes to light.

A new, food-sharing, hominid emerges

Take, for example, the consumption of a wild horse, half a million years ago on the coast of southern England. All that remains of a full day's intensive activity – spearing, dismembering, filleting, bone cracking and marrow sucking – are a few of the heavily fragmented bones and many of the cracked flints used to take the horse apart. Yet the rapid burial by coastal muds captured enough of the spatial patterning of food-sharing debris for the meticulous work of archaeologists to reveal a remarkably detailed story half a million years later.

The Palaeolithic excavations and research at this site, known as the Boxgrove project, showed a different species of *Homo* at work, with a different cognitive capacity. These early European colonisers would have had some 'language', although were probably not sustaining prolonged eye contact or engaging in 'conversation'. This food-sharing scene might instead have displayed resonances with meat sharing among chimpanzees, with a succession of sharing transactions, bargaining for power and sexual favours. However, one aspect would be very different: members of our own genus *Homo* bring down some very large animals, with 20 times the meat yield of the monkeys and bushbucks that chimps hunt. This implies a lot of individuals and food shared on an unprecedented scale in social terms.

Learning to cook

Our closest relatives may well be the Neanderthals, who shared food and had some essentially human attributes at mealtimes, including another very odd feature of the human food quest – cooking. We are not alone in exploiting natural fires; several types of foraging animals are known to take advantage of forest burns. But the Neanderthals left clear evidence that they were able to initiate fires within their rockshelters.

One such shelter, at Abric Romani near Capellades in Spain, had around 30 hearths within a single level, trapped and engulfed by lime accumulation from the dripping shelter's roof. Neanderthals camped at this site around 70,000 to 32,000 years ago. From Neanderthal hearths around Europe, we can tell that they were placing meat, shellfish and legume pods in the fire. Their meals, however, didn't display all the signs of 'home cooking'.

The phrase 'home cooking' brings to mind an intimate and familiar group, sitting around the hearth, looking across to each other while they share food. Yet this does not quite describe the Neanderthal hearths. They are not typically centrally placed within their shelters and do not give an impression of a conversational circle assembled around them. For hearths of that kind, we need to look to the early habitations of our own species, *Homo sapiens sapiens*, and when we find such hearths, we find much else besides: the first characteristics of a 'home'.

Hearth and home

Together with Czech colleagues, a group of Cambridge archaeologists have in recent years been excavating some early traces of hearths. In the East of the Czech Republic, deep deposits of wind-blown earth have buried and conserved human settlements that are 25–30,000 years old. As the sediments are removed, the final remnants of the oldest recorded built spaces come to light – circular or oval structures erected from skin, branch and mammoth bone. At the heart of these built spaces is a hearth, with a space around it where people sat. The archaeologists are collecting and studying the animal and plant fragments from the meals they shared. They are also rebuilding whole food webs from an isotopic study of the bones, and employing novel methods of microstratigraphy to work out how often, and at what intervals, they returned to the hearth.

These hearths are also the sources of a range of small objects, fashioned into the form of the people and animals encountered in the landscapes around them. They were probably both made

and used around the same hearths, perhaps as props for the telling of stories – stories of journeys into the bleak unknown, to encounter and capture hostile beasts and to find food. The flint blades found alongside retain a geological signature of such journeys. The stone from those blades has travelled distances up to 300 km, an incredible 600 km round trip through hostile and wintry terrain.

There are other finds around those ancient hearths that add detail to this picture. Clay impressions of the world's earliest recorded weaving, and a few pierced beads of tooth and shell, alongside scatters of red ochre, allude to the adornment of bodies.

And so we begin to see the elements of our strange modern human feeding behaviour falling into place. An intimate group returns repeatedly to a home or hearth, they dress to demarcate age and gender, they share food and, looking eye to eye, converse and tell stories. Their words place things and beings into categories, and their stories put their world in order. Those stories also equip their young to set out on elaborate journeys – journeys that are intimately connected with their food quest and the meals shared around the hearth at the journeys' ends, journeys that in turn will eventually take our species to the ends of the Earth.



Professor Martin Jones

For more information, please contact the author Professor Martin Jones (mkj12@cam.ac.uk) at the Department of Archeology. *Feast: Why Humans Share Food* by Martin Jones is published by Oxford University Press, ISBN 978-0-19-920901-9.

Chocolate heaven: Food-engineering research using MRI

Chocolate manufacture is an age-old process that can be traced back to the Maya Indians. Over a thousand years later, MRI is being used to help perfect the technique.

Most of us are familiar with the use of magnetic resonance imaging (MRI) to scan the human body for signs of disease. Magnetic fields up to 30,000 times stronger than the Earth's magnetic field plus radiowaves are passed through the body, exciting the hydrogen atoms within. Because different tissues contain different amounts of hydrogen atoms in different environments, a scanner can turn these detected signals into an image of the body.

Like the human body, chocolate is largely composed of fat and water, which contain the hydrogen atoms needed to perform MRI. In recent years, researchers have begun to use MRI to provide precise information about the processing, properties and quality of food products like chocolate.

Food engineering involves the processing of basic food materials such that the resulting physical and chemical transformations can deliver the desired properties to the final food product. For chocolate, this means colour and flavour, a silky, smooth finish, good sheen, a crisp break and no crumbling.

At the Magnetic Resonance Research Centre (MRRC), a range of industrial food-processing routes are imaged *in situ* in a non-invasive manner using MRI. These are generally dynamic systems, requiring the application of ultra-rapid MRI techniques, the development and application of which is a unique strength of the MRRC. Insights delivered by the time-resolved images are used both to inform process improvements and to validate rigorous process simulation.

In particular, the MRRC explores the intermediate creation of chocolate 'crumb' from various fats, sugars, water and milk products. In industrial chocolate manufacture, this chocolate crumb is further refined by 'conching' and 'tempering' – intensive processes that ultimately define the taste, texture and smell of chocolate. The goal is to reduce the particle size of the cocoa solids and sugar crystals to less than the size that can be detected by the human tongue.

For crumb manufacture, the chocolate ingredients are mixed to form a wet paste, then dried as slabs in large vacuum

ovens to form the crumb. At the MRRC, MRI is used to quantify the water distribution during the paste-crumb transformation in a vacuum oven as a function of time. MRI slices are extracted from a three-dimensional (3D) image showing the residual water distribution. This non-invasive technique enables the drying regime to be identified (heat-transfer controlled), and also serves to verify simulation models of the crumb-forming process; these can now be used with increased confidence and have led to significant energy-saving process modifications.

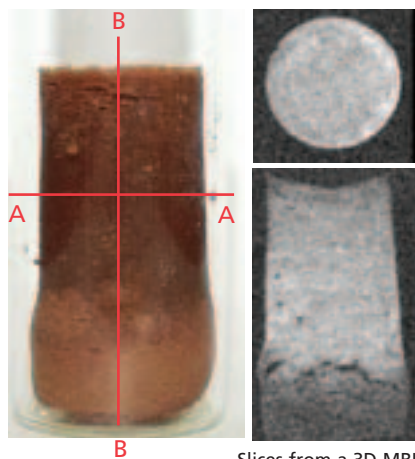
A particular strength of MRI with respect to food-processing studies is its ability to map out the full 3D velocity field in the equipment *in situ*. This means that the mixing and shearing of the food can be directly quantified, as well as any resulting physical and/or chemical changes.

One of the most enjoyable aspects of eating chocolate – the 'melt in the mouth' experience – is based on the fact that the melting point of chocolate is slightly below our own body temperature. MRI-based information generated by the MRRC can ultimately lead to energy-saving improvements in the manufacture and quality of chocolate; all helping to improve the delivery and quality of this experience.



Dr Mike Johns

For more information on applications of MRI to food-processing studies, please contact the author Dr Mike Johns (mlj21@cam.a.uk) at the Magnetic Resonance Research Centre, Department of Chemical Engineering.



Slices from a 3D MRI image of partially dried chocolate crumb. Top right: Section A-A. Bottom right: Section B-B

DR MIKE JOHNS

FOOD AND MEDICINE IN CLASSICAL GREECE: THE 'BLURRED BOUNDARY'



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The Hippocratic Collection is our earliest written source for deciphering the history of Greek medicine. This collection of about 60 texts was written by several authors on a multitude of medical topics, and was preserved under the name of Hippocrates – the famous physician born around 460 BC who later became known as the 'Father of Medicine'.

An important tenet of Hippocratic theory is the emphasis on dietetics. Broadly speaking, dietetics is the tailored application to individual needs of regimens encompassing all aspects of daily life. This is distinctive of Hippocratic medicine, not being found in earlier Greek texts or in medical documents from Mesopotamia and Egypt. Dietetic medicine has consequently attracted the attention of scholars, sometimes to the detriment of other aspects of Hippocratic medicine, especially pharmacology. However, Dr Laurence Totelin, a research fellow in the Department of History and Philosophy of Science, who studies ancient pharmacology, has come to the conclusion that the boundary between dietetics and pharmacology in ancient Greece was much more blurred than previously thought. In fact, Dr Totelin believes that dietetics, pharmacology and other ways of treating diseases in antiquity are part of an integrated system and should be studied as such.

The 'boom' in dietetic medicine in 5th-century Greece seemed to have led to reflections on what distinguished a 'food' from a 'drug'. For instance, the author of the Hippocratic treatise *Places in Man* writes that:

'All things that cause change in the present state [of the patient] are drugs, and all [substances] that are rather strong cause change. It is possible, if you want, to bring about change by means of a drug, or, if you do not want [to use a drug], by means of foods.'

Although the writer manages to define the notion of 'drug', he is not so successful at defining the notion of 'food', or the difference between a

food and a drug. In many cases, this distinction must have been very blurred indeed.

As an example, silphium, an umbelliferous plant exported from the ancient Greek city of Cyrene and now thought to be extinct, was used both as an expensive way to enhance dishes and also to treat serious medical conditions. Authors writing on dietetics described silphium as a 'windy' plant, similar to garlic, leek or other 'sharp' herbs. Silphium was prescribed in gynaecology against 'winds in the womb' or to 'create a wind in the womb'. Although 'winds in the womb' referred to a genuine condition, 'to create a wind in the womb' may have been a euphemistic way to refer to an abortion; another important use of the herb was indeed as an abortive. It seems that silphium was primarily exported from Libya as a culinary herb and that the medicinal uses of the plant stemmed from its uses in cooking.

With time, the definition of 'drug' as opposed to 'food' became clearer. The Aristotelian *Problems* (a 3rd-century BC collection of texts attributed to Aristotle) state that foods are 'concocted' and assimilated by the body, whereas drugs penetrate into the vessels, where they cause disturbances due to an excess of heat or cold.

However, in practice, the boundary between food and drug remained blurred throughout antiquity, with plants like myrrh, silphium, pomegranate, frankincense and cinnamon finding a place in both dietetic treatises and in texts devoted to drugs. This research highlights the historical importance of studying the interaction between dietetics and pharmacology in ancient medicine, and of examining how definitions of 'foods' and 'drugs' evolved from antiquity to the present day.

**What
distinguishes
a drug from
food?
Laurence
Totelin traces
the emergence
of a definition
in ancient
Greece.**



Dr Laurence Totelin

For more information, please contact the author Dr Laurence Totelin (lmvt2@cam.ac.uk) at the Department of History and Philosophy of Science.



Blood collected from volunteers is stored as straws in liquid nitrogen

You are what you eat: Investigating nutrition and cancer

We all know that a good diet is key to good health, but it's now clear that certain foods we eat can unmask underlying susceptibilities to cancer.

Genetic factors are known to be important in determining propensity to develop cancer but there is strong evidence that the worldwide variation in cancer incidence is mainly due to our lifestyle and environmental factors such as the food we eat. A deeper understanding of this relationship is being afforded by the largest study of diet and health ever undertaken, involving over half a million people in ten countries. Researchers at the Medical Research Council (MRC) Centre for Nutritional Epidemiology in Cancer Prevention and Survival (CNC), in the University of Cambridge's Department of Public Health and Primary Care, are building on these findings under the directorship of Professor Sheila Bingham.

Cancer incidence worldwide

Geographically, when age is taken into account using world-standardised rates, there are up to 100-fold variations in the incidence of particular cancers in different regions of the globe. The incidence of colon cancer, as an example, varies 20-fold between the highest (USA) and the lowest (India) incidence. Even across Europe there are marked differences in cancer rates, with incidence rates in Greece being about half those of Germany.

- Worldwide, about 10 million people are diagnosed annually with cancer and more than 6 million people die of the disease.

- The most common cancers worldwide (excluding non-melanoma skin cancer) are lung (12.3%), breast (10.4%) and colorectum (9.4%).
- In developed countries, the main cancers are of the lung, large bowel, breast, prostate and bladder.
- In developing countries, the main cancers are of the cervix, liver, stomach and mouth.
- In sub-Saharan Africa, cancer of the large bowel, breast and lung are virtually absent.
- 'Hot spots' exist for cancers at certain sites: oesophageal cancer in parts of Iran and nasopharyngeal cancer in parts of South-East Asia.

Studies of migrants moving from a low- to a high-risk area have shown that the migrants acquire the cancer pattern of the host country within a relatively short period of time – as swiftly as within a single generation.

Over the past 40 years in Japan, colon cancer has increased enormously and the incidence of bowel cancer in Japanese men is now twice that of men in the UK, despite being extremely rare only 40 years ago. It's clear that changes in the gene pool cannot account for such rapid changes in Japan. A more likely explanation is that the Japanese population have a susceptibility to this cancer that has been unmasked by their rapidly changing diet.

What is the link with nutrition?

There are very strong links between the amount of certain dietary items consumed, together with the dietary practices used in various populations, and the incidence rates for common cancers. On the basis of such comparisons, it has been estimated that 32–35% of cancers could be attributed to nutrition, although the contribution of diet to specific types of cancer varies from as low as 10% for lung cancer to as high as 80% for cancer of the large bowel.

Even so, there is a complex interaction between genetic factors, individual metabolic characteristics and diet. By themselves, common variants in genes that regulate the metabolism of food constituents are unlikely to confer large cancer risks, but they could do so in individuals who smoke, drink or have a particular dietary pattern. Links between diet and cancer can therefore only be found by measuring not only gene variants but also dietary exposure in populations. To do this, you need to study as large a number of people as possible – which can only be made possible through significant collaboration.

An EPIC study

The European Prospective Investigation into Cancer and Nutrition (EPIC; www.iarc.fr/epic) is the largest study ever to investigate specifically the relationship between diet, metabolic and genetic factors, and certain types of cancer. EPIC includes 519,978 volunteers (366,521 women and 153,457 men) who have been recruited to 23 regional or national centres in 10 countries across Europe. Blood was collected from approximately 400,000 subjects at enrolment and the different fractions were stored under special conditions as straws in liquid nitrogen pending further analysis. By studying people in different countries with differing diets, it is anticipated that specific information about the effect of diet on long-term health will be discovered.

EPIC is an enormous resource and, since its inception in 1992, numerous papers have been published by the study collaborators, at a fast increasing rate as more and more cancers develop within the cohort; 75 papers were published in 2006. Of these, two key published findings have been that an approximate doubling of dietary fibre intake is associated with a 40% reduction in colorectal cancer incidence and that red and processed (but not white) meat is associated with an increase in risk of colorectal cancer, whereas fish is protective. A further finding was that eating vegetables and fruits did not appear to protect against breast cancer.

Collaborating centres in the UK

In the UK, there are two EPIC collaborating centres, one based in Oxford and the other at the University of Cambridge's Institute of Public Health (EPIC Norfolk; www.epic-norfolk.org.uk), which has recruited 25,000 men and women from Norfolk. EPIC Norfolk has taken an important lead in the biostatistical handling of data, in collaboration with the MRC Biostatistics Unit, and in developing nutritional methods for measuring diet on such large population samples. One of the important findings of EPIC Norfolk has been the demonstration that fat could be an important risk factor in breast cancer, a finding that has been replicated in a subsequent study in the USA.

The search continues

CNC, a new MRC Centre awarded to the Institute of Public Health, builds on the success of the Europe-wide EPIC collaboration, and is the focus of a unique consortium of cohorts of approximately 100,000 participants from several UK universities investigating how

diet can prevent cancer. Cancer survival in relation to diet is being assessed in the SEARCH (Studies of Epidemiology And Risk Factors in Cancer Heredity) study of cancer genetics in breast, bowel, prostate and ovarian cancer survival and prognosis. CNC also fosters epidemiological biomarker studies into the mechanisms whereby nutritional factors are involved in DNA alterations leading to mutation and ultimately tumour development.

Cancer is still one of the most common causes of death in western countries, including the UK. As a significant number of cancers may be the result of diet, studies at EPIC Norfolk and the CNC will provide a crucial focus for nutritional epidemiology and our future understanding of the link between nutrition and cancer.

'32–35% of cancers could be attributed to nutrition.... from as low as 10% for lung cancer to as high as 80% for cancer of the large bowel.'



Professor Sheila Bingham

For more information, please contact the author Professor Sheila Bingham (sheila.bingham@srl.cam.ac.uk) at the CNC (www.srl.cam.ac.uk/cnc).



The psychology of gambling

Gambling is a thriving form of entertainment in the UK, but may also become a form of addiction for some individuals. Just why do people gamble when 'the house always wins'? Advances in brain imaging techniques are helping Cambridge scientists find out.

Gambling has been a popular source of entertainment for many centuries and across many cultures. With current changes in gambling legislation in the UK, its popularity looks set to continue. New casinos are to be established, including a large 'super-casino', and novel forms of gambling like internet gambling and electronic gaming machines are flourishing. Some argue these changes are a good thing: gambling is a recreational activity enjoyed by around 70% of the British public at least annually, and the gambling industry is a useful source of taxable revenue.

But all this comes at a cost – for a minority of individuals, gambling is a spiralling habit that they become unable to control. Problem (or 'pathological') gambling is a recognised psychiatric diagnosis present in around 1% of the population. These prevalence rates are higher in local communities around gambling facilities, and clinicians are concerned that the relaxation of British legislation will increase the incidence of problem gambling in years to come.

Against the odds

At its heart, gambling is a rather paradoxical behaviour because it is widely known that 'the house always wins'. Whether you are gambling on fruit machines, horseracing, blackjack or roulette, the odds will have been meticulously arranged to ensure a steady profit for the casino or bookmaker. The only way to achieve this is for the gambler to make a steady loss. So why do gamblers, and particularly problem gamblers, continue to play when the overwhelming likelihood is that they will lose money?

Dr Luke Clark, in the Department of Experimental Psychology, is interested in the different ways in which gamblers over-estimate their chances of winning, including the effects of near-misses and personal choice. These features of gambling games promote an 'illusion of control': the belief that the gambler can exert skill over an outcome that is actually defined by chance.



Promoting an illusion of control

Near-misses occur when the outcome is close to the jackpot, but there is no actual win. Near-misses are common in many forms of gambling, such as when your chosen horse finishes in second place in a horserace. A moderate frequency of near-misses encourages prolonged gambling, even in student volunteers who do not gamble on a regular basis. Problem gamblers often interpret near-misses as evidence that they are mastering the game and that a win is on the way.

Personal choice is a further determinant of illusory control, referring to situations where the gambler has some responsibility in arranging their gamble. As an example, roulette players will place higher bets if they can throw the ball onto the roulette wheel themselves, compared with if the croupier throws the ball for them. Lottery players often prefer a number sequence they have selected themselves, and may refuse to exchange their ticket for several tickets of random numbers. Choice appears to encourage a belief that the game involves skill when in fact the outcome is entirely random.

Imaging the gambling brain

Recent advances in brain imaging technology are helping scientists to understand how these features of gambling games are so effective in maintaining continued play. At the Wolfson Brain Imaging Centre at Addenbrooke's Hospital in Cambridge, Dr Clark is using functional magnetic resonance imaging (fMRI) to measure patterns of brain activity while volunteers perform a gambling game.

Previous research has shown a reliable pattern of brain activity when humans receive monetary wins. In particular, a region called the striatum, near the centre of the brain, is a crucial component in a reward circuit that also responds to natural reinforcers like food and sexual stimuli, as well as drugs of abuse like cocaine. In ongoing research, Dr Clark is measuring activity in this reward circuit as volunteers experience near-misses and choice effects during a gambling task.



Dr Luke Clark

For more information, please go to <http://research.psychol.cam.ac.uk/~bcni/> or contact the author Dr Luke Clark (lc260@cam.ac.uk), who throughout 2007 will be looking for regular gamblers to participate in ongoing experiments. This research is supported by the Economic and Social Research Council (ESRC), the Responsibility in Gambling Trust, and the MRC/Wellcome Trust Behavioural and Clinical Neuroscience Institute.

Hallmarks of addiction

Both near-misses and personal choice cause gamblers to play for longer and to place larger bets. Over time, these distorted perceptions of one's chances of winning may precipitate 'loss chasing', where gamblers continue to play in an effort to recoup accumulating debts. Loss chasing is one of the hallmarks of problem gambling, which actually bears much resemblance to drug addiction. Problem gamblers also experience cravings and symptoms of withdrawal when denied the opportunity to gamble.

In addition to an array of psychological factors, problem gambling may also have some important biological determinants. The brain chemical dopamine is known to play a key role in drug addiction and may also be abnormally regulated in problem

gambling. Patients with Parkinson's disease, who show degeneration of dopamine cells, can sometimes show a sudden interest in gambling, linked to their use of medications that increase dopamine transmission. Other systems in the brain are also critical, particularly the part of the frontal lobes immediately above the eye sockets, known as the orbitofrontal cortex.

Following damage to the orbitofrontal region, neurosurgical patients often show changes in their judgment and risk-taking. One patient, examined at the University of Iowa, made a series of disastrous decisions involving extravagant business ventures and dubious personal relationships after having a tumour removed from his orbitofrontal cortex. In a collaborative study with Dr Antoine Bechara at the University of Southern California, Dr Clark is measuring betting behaviour in a group of similar patients with damage in this region, using a simple gambling task. More subtle chemical imbalances in this brain region may accompany the transition from regular gambling to problem gambling.

Help for problem gamblers?

By further understanding the breakdown of self-control in gamblers, this programme of research carries important implications for the treatment of problem gambling, using both pharmacological and psychological therapies. Moreover, the development of objective tasks of gambling will provide more valid outcome measures for assessing the effectiveness of new treatments. By understanding how subtle features of gambling games, like near-misses and personal choice, are linked to the addictiveness of these games, future changes in gambling legislation may be in a better position to protect vulnerable individuals.

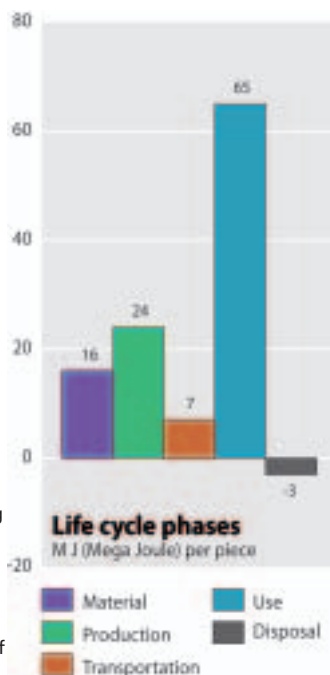
As clothes become cheaper and fashion becomes 'faster', how are we to balance our consumption with environmental, economic and social sustainability?

Well dressed?

Growing out of the 'green' movement of the 1960s, concerns over the environment began to turn towards 'sustainability' in the 1990s. Today, interest is also sharply focused on the issue of greenhouse gas emissions, and consumers in developed economies have become increasingly aware of the environmental impact of the products they buy and the social conditions of those who make them.

There are signs that this awareness is beginning to influence the way people shop. Last year, Marks and Spencer (M&S) decided, at some risk, to convert all of its coffee and tea sales to products made under the 'Fairtrade' agreement (which helps disadvantaged producers in the developing world). Sales grew 12% immediately and, after a year, remain 6% higher than previously.

These environmental and social concerns are no less true for the clothing industry. Dr Julian Allwood and researchers at the Institute for Manufacturing in the Department of Engineering have been exploring the environmental, social and economic sustainability of a wide range of future scenarios for the supply of clothing and textiles to the UK. The project involved five person-years of effort and led to a major report entitled *Well Dressed?* published in December 2006.



Laundering clothes consumes the most energy during the life cycle of a T-shirt

A world trade

The clothing and textile industry is a significant part of the world's economy:

- In 2000, approximately \$1trillion was spent on clothes by consumers worldwide, a third of this in western Europe and a third in North America.
- The industry directly employs at least 26 million people and accounts for around 7% of total world exports.
- More than a quarter of the world's production of clothing and textiles is in China, with Pakistan, Bangladesh and India also making a significant contribution. Trade in clothing and textiles accounts for more than 70% of the exports of Cambodia, Bangladesh and Pakistan.
- The European Union and Mediterranean region retain a strong clothing and textiles industry – with over 4 million people employed, including around 200,000 in the UK.
- In the UK, we spent an estimated £625 per head on clothing in 2004. Increased spending between 2001 and 2005 coincided with dropping prices largely due to the rise of 'fast fashion' – with sales at supermarkets and chains such as H&M and Zara providing a faster turnover of styles than previously.
- Today, we are purchasing and disposing of around 35 kg of clothing and textiles per person each year, of which around 13% is collected for re-use, 13% is incinerated, and the remainder – 26 kg per person – is buried in landfill.



The price of fast fashion

The environmental consequences of our textile consumption are complex and occur at different stages of a garment's life: from the cultivation of cotton, through garment manufacture, laundering and disposal at the end of its life.

Specific effects on the environment include the use of toxic chemicals in cotton agriculture and manufacture; the high water consumption, particularly for cotton crop cultivation; the contribution to climate change through energy use during manufacture and by laundering clothes; and the solid waste created from the manufacture and disposal of clothing.

These environmental concerns go hand-in-hand with social concerns about the employment of low-paid workers in developing countries, particularly their working hours and safety, and the use of child labour. There are recognised needs for a realistic minimum living wage that would allow workers to escape a cycle of poverty and the rights of workers to form unions.

The solution? Buy less, keep it longer

The main conclusion of the analysis is that the impacts of the sector are largely driven by the volume of material passing through it – so the greatest beneficial change would occur if we purchased less clothing and kept it for longer. Although this appears economically negative, it need not be – it could be achieved if we spent twice as much on half the number of (higher quality) garments.

Separately from reducing the flow of material, improvements can be achieved by increasing the efficiency of each process applied to the material. The most important process at present is that of laundering – washing clothes at lower temperatures and hang-drying to avoid use of a tumble dryer would approximately halve the total life-cycle energy used by cotton garments. Also, moving from conventional to organic cotton would eliminate the use of toxic chemicals. And increasing the re-use of materials (particularly of man-made materials such as polyester) would save the high energy requirement of new material production.

Weaving the threads of change

An understanding that emerged from this study is that any change that will result in environmental and social benefits in the textile industry will be driven by consumers. How would an 'ideal' consumer act? They would buy fewer, longer-lasting garments, choosing those with the least 'carbon footprint' made by workers in reasonable working conditions; buy more second-hand clothing; wash clothes less often at a lower temperature using eco-detergents; and recycle those clothes that had reached the end of their lives.

If consumers change their behaviour, companies will follow very quickly, and politicians may follow also. The experience of M&S with Fairtrade tea and coffee shows how companies can begin to take a lead in supporting such change – but however willing the company, they can only move with their customers. Consumer education is the key to supporting a move towards beneficial change. The very positive media reaction to *Well Dressed?* has shown that there is growing public interest in responding to concerns about 'sustainability' and it is hoped that some of the outcomes will also translate to other sectors.



Dr Julian Allwood

For more information, please contact the author Dr Julian Allwood (jma42@cam.ac.uk) at the Department of Engineering. This research was funded by the UK's landfill tax credit scheme through Biffa and a contribution from M&S. The full report *Well Dressed? The Present and Future Sustainability of Clothing and Textiles in the UK* can be downloaded from www.ifm.eng.cam.ac.uk/sustainability/projects

In pursuit of happiness

Who and where are the happiest people in Europe? Traditional stereotypes have suggested that southern Europeans, who hail from the warmer Mediterranean regions, are far happier and more satisfied with life than their northern European counterparts. But data drawn from the latest waves of the European Social Survey (ESS; <http://naticent02.uuhost.uk.uu.net>) suggest that the map of well-being across Europe displays the converse of this conventional image.

In 2004, Italy, Greece, Portugal and France reported the lowest levels of well-being relative to the Scandinavian countries, the Netherlands and Luxembourg. The happiest people in Europe are in fact the Danes: in 2004, 80% of Danish respondents reported levels of happiness above the European average. The UK ranks 9th in the league with 74%; at the bottom of the list come the Italians with 26%.

These findings beg the question: what actually determines well-being? Who and where are the happiest Europeans? What factors, besides location and climate, affect an individual's state of happiness and life satisfaction? Answering these questions has been the aim of Dr Luisa Corrado and Aqib Aslam at the Faculty of Economics.

Defining well-being

The first task was to disentangle the notion of well-being. Specifically: is well-being synonymous with happiness?

In recent years, as standards of living have risen drastically, the emphasis has been on the pursuit of 'happiness' expressed as the hedonistic desire for pleasure. Government emphasis on economic growth did suggest that money could go a long way to buying 'happiness'. But, for most individuals, more money adds little to the quality of their life.

The concept of well-being, as stressed in psychology, is inclusive of the concept of eudaimonia (or life satisfaction) above and beyond the Bacchanalian concept of hedonism (maximising pleasure). Life satisfaction is the human desire for overall fulfilment – covering such themes as self-actualisation and a commitment to socially shared goals. This allows a dual measure of well-being to be defined: the need for short-term happiness but long-term life satisfaction.

Armed with these twin concepts, Dr Corrado sought to understand their drivers across different levels of society, both regionally and nationally, to understand how the European map of well-being has developed. Looking at the aggregate data for life satisfaction in 2004, Denmark once again is top, with 82% reporting levels of life satisfaction above the European average, the UK scores 10th with 62%, whereas Portugal is bottom with 17%.

What factors determine well-being?

Evidence from the ESS shows that individuals from northern Europe scored highest in terms of quality of government and per capita income. Although it is important not to neglect the influence of material comforts, Dr Corrado's analysis showed that, except for the richest, income was not a significant determinant of either concept of well-being – happiness or life satisfaction. So what is affecting individual well-being? Is it the quality of our institutions, our governments' policies, or interactions with our regional neighbours, family, friends and people in general?

One of the major contributions of the project in the Faculty of Economics is to have applied an alternative methodological approach that can correctly answer this question. The determinants of well-being are now assessed using hierarchical modelling of data at the national, regional and individual levels.

The research showed that certain individual variables such as the level of trust in government, society and the legal system were significant, as well as the

Analysis of the results of a Europe-wide social survey is providing clues as to why some Europeans are happier than others.

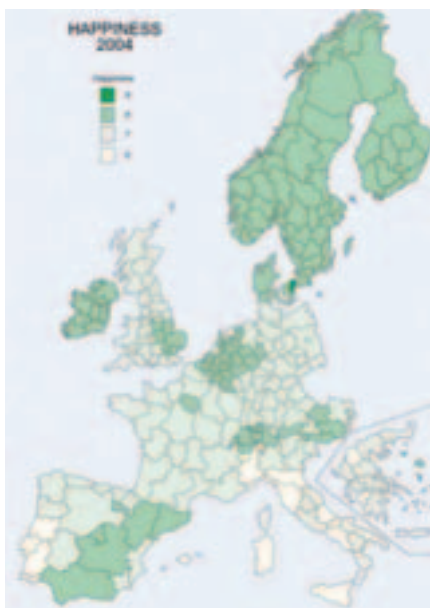
levels of political interest, social engagement and perceived altruism. It was also concluded that, although certain regional and national attributes were significant, it was primarily individual attitudes that best explained well-being. And, alongside subjective beliefs, socio-demographic indicators such as age and marital status were also key drivers.

These results help us to understand how certain regions across the EU-15 could be 'happier' or 'more satisfied' than others:

- Trust in Parliament: Denmark is top, the UK scores a mere 12th in the ranking and Portugal scores lowest.
- Trust in society: once again Denmark is highest, the UK scores 7th and Greece is bottom.
- Trust in the legal system: Finland comes first, the UK scores 9th and Portugal comes last.
- Perceived level of altruism: Ireland scores highest, the UK scores 5th and Greece is bottom.

Because of the significance of these institutional factors in well-being, the low scores of southern Europe could explain why they lag behind the north in 'happiness'.

DR LUISA CORRADO



No man is an island

Is it possible to define an ideal formula for well-being? The incisive words of the 17th-century writer John Donne hold particular resonance in this: 'No man is an Island, entire of itself; every man is a piece of the Continent, a part of the main.' The qualitative results of this project broadly confirm that we are ultra-social creatures who attain personal fulfilment through social inclusion and goal-congruence, be it through family, friends, society or institutions.

In this respect, Europeans who report the highest level of well-being could represent a role model to develop new well-being-based government policies. The measure of well-being across Europe would be much less scattered if governments could export the successful model from the northern Europeans to other countries. This project clearly shows that social interactions are the drivers of well-being and should be considered when developing adequate social and economic policies.

As Dr Julian Oldmeadow of the Department of Social and Developmental Psychology also stresses: 'Philosophers, sociologists and social psychologists have long known that societies do not run on rewards and punishments alone. Societies

function best when citizens feel included, valued and respected by their families, groups and authorities. In the long term, these factors are at least as important as money. No doubt we are social creatures, and policy-makers and economists would do well to acknowledge our social motives as much, or more than, our financial ones.'

Dr Corrado's findings suggest that well-being would flourish if we lived in a supportive and trusting society. But have governments correctly identified these issues? Perhaps future politicians will be judged on the basis of improvements in well-being as much as by how much the economy performs.



Dr Luisa Corrado

For further information, please contact the author Dr Luisa Corrado (lc242@econ.cam.ac.uk) at the Faculty of Economics. *No Man is an Island: the Inter-personal Determinants of Regional Well-Being in Europe*, by Aqib Aslam and Luisa Corrado, can be found at www.econ.cam.ac.uk/faculty/corrado The research is part of the Marie-Curie Project 514913 led by Dr Corrado.

Map of national averages for happiness and life satisfaction in 2004 (darker colours score higher)

The influential 14th-century Muslim scholar Ibn Khaldun once said that the size of monuments is proportionate to the power of their founders and that we may indeed wonder at the strength and prowess of our predecessors as we view their remains. In Spain and Morocco, Islamic mosques, palaces, towers and fountains can be discovered everywhere, from the delicate Ja'fariyya palace in Zaragoza to the soaring tower of the Cathedral of Seville, once minaret of the city's great mosque, and its sister towers in Rabat and Marrakesh. From Cordoba to the Sahara, quintessentially Arab arabesques intermingle with the cross-hatched brick designs of the Berbers and an occasional motif borrowed from the Christians of Iberia – a scallop shell in Marrakesh and shields inscribed in Arabic in the famous Alhambra palace in Granada.

However, splendid though they are, it's not the aesthetic qualities of this architecture that primarily interest Dr Amira Bennison in the Faculty of Oriental Studies. As a historian, her interests lie in exploring the ramifications of Ibn Khaldun's comments and seeing what these buildings tell us about the dynasties that constructed them and the people over whom they ruled. In a sense she is interested in physical structures as propaganda.

To answer these questions, Dr Bennison has spent the past few years sifting through Arabic chronicles from medieval Islamic Iberia and Morocco for descriptions of buildings and cities, and the ceremonies of power that took place within them, to give a better understanding of how each dynasty was viewed by its Muslim, Christian and Jewish inhabitants. As more material is gathered, it is compared and contrasted with archaeological and architectural evidence to create a picture of how the remains we see today were experienced by the society that produced them.

The legacy of the Umayyads

One of the cities for which most detail has been gathered is Cordoba during the Umayyad era (757–1031). As any tourist will know, Cordoba's greatest Islamic monument is its Great Mosque, but of equal importance is the less well-known palace-city of Madinat al-Zahra' located just three miles outside the city. Each of these sites expressed Umayyad self-identity in a different way.

When the Umayyads founded the Great Mosque in the late 780s, a small Muslim elite ruled a vast Christian subject population. In constructing the mosque, they cleverly emphasised continuities with the past as well as establishing

The palatial language of power

By sifting through medieval Arabic chronicles from Islamic Spain and Morocco, a picture emerges of how the evocative, but frequently abandoned, palatial remains we see today were experienced by the society that built them.

Islam's new place in Cordoba. The mosque was built on the site of a church that Christians and Muslims had reputedly shared before Muslims purchased it from their Christian fellows. Inside, the horseshoe arches evoked Visigothic church architecture, and the alternating red and cream voisoirs created a visual link with the Roman aqueduct at Mérida. Moreover, the derelict Roman bridge over the Guadalquivir river close to the mosque was carefully restored and came to be celebrated as one of the wonders of Islamic Spain. In such ways, the Umayyads projected an image of themselves as the legitimate heirs of preceding non-Muslim regimes.

The message of Madinat al-Zahra', built in the 10th century when the majority of the population had become Muslim, was different. It celebrated the religious and political role of the Umayyads as the foremost Muslim rulers of their day and created a space for grand international receptions.

The Umayyads understood their new role in an expansive way, which grew out of their earlier sense of their imperial Mediterranean heritage. They welcomed visitors from as far afield as Saxony, and sent embassies back to the court of Otto I. They corresponded with the Byzantine emperors as equals and requested craftsmen to help refurbish the Great Mosque. Moreover, the Christians and Jews of Cordoba played an important role at the new Umayyad court as translators, ambassadors and patrons of culture.

Fortresses of the faith

Although the Umayyad polity collapsed in the 11th century, successive regimes in Spain and Morocco made references back to the Umayyad model in their own architecture. But the growing threat to Muslim power from the Christian kingdoms of the north heralded a new more defensive and militant attitude on the part of rulers such as the Berber Almoravids and Almohads, who made much of their ability to defend the lands of Islam and rather less of Islam's tolerant and integrative aspects.

During this period, fortifications began to dominate the landscape, and the Almohad great mosques built in Seville, Rabat, Marrakesh and many other cities loomed large as fortresses of the faith. The sources show that religious minorities lost their place in society and began to face the kind of persecution characteristic of societies on the defensive.

Tour Hassan, Rabat, Morocco



Portraits of everyday life

The Arabic chronicles also yield delightful vignettes of a society distant from our own but familiar in its humanity. As one reads through the 11th-century chronicle of Ibn Hayyan, one comes across picnics by the side of the Guadalquivir river at which poetry was recited in the shade of the trees; a sudden rain storm one Friday that drenched the congregation in the great mosque, who scattered for cover leading to the abandonment of the prayer that week; and bitter rivalries for the affections of the ruler. The sources also reveal the violent side of this lost world: dead rebels suspended before the gates of the palace as a warning to others and dreadful cycles of famine and disease.

Relevance to modern times

Perhaps what is most relevant to us today is to see a sophisticated and confident Islamic society willing to integrate 'others' and able to contribute beyond its own boundaries. The Muslims of the medieval west were proud and exhibited a sense of their cultural and religious superiority but they were also practical. Political relationships were dictated by good sense not religious affiliations, marriages frequently took place across confessional lines, and rulers knew when to evoke polemical rhetoric and when to leave it quietly to one side.

When the historical context changed, architecture, ideology and society itself also began to alter. Although Dr Bennison's research focuses on specific questions, in a more general sense Islamic Spain is a site for re-thinking stereotypes and for recognising the contribution made by Muslims of an earlier age to ecumenicism and cultural exchange. It also reminds us that religious invectives and intolerance are not inherent to any faith but are the product of specific political, economic and social contexts.



Dr Amira K Bennison

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In search of poppies and crocus: plant collecting in modern times

Thanks to ongoing research in the field, visitors to the Botanic Garden can experience the fascination of plant diversity and relate this to their understanding of our planet's uniquely different habitats.



The source or origin of a plant growing in the Cambridge University Botanic Garden (CUBG) may at first seem unimportant given that a vast range of ornamental plants is readily available through UK nurseries. But do these selections and hybrids meet the needs of CUBG as a botanic collection? To represent global plant diversity, we need to grow a much wider range of plants – sometimes unusual, not always ornamental and often of wild origin.

Call of the wild

Collections from the field are vital for research and to conserve species under threat in their native habitat, pending the development of appropriate re-introduction programmes. Some plants have survived only because of botanic garden collections. One of these, a grass known as interrupted brome (*Bromus interruptus*), used to be widespread in the arable fields of southern England, but improved seed cleaning and the use of herbicides led to its decline and final extinction in 1978. The last documented population was recorded in a field in Pampisford, near Cambridge. Thankfully, a plant survived in cultivation and CUBG was one of the few gardens that have ensured its survival. In a project led by the Royal Botanic Gardens at Kew, our Cambridge plants have now been propagated and re-introduced back into the wild in two locations.

To be of core value to the activities and purpose of a botanic garden, the plant collections should ideally be of

documented wild origin. Because of this, expeditions to collect authentic material from the field have always played a vital role. As examples, CUBG collections of *Alchemilla*, *Fritillaria*, *Geranium* and *Lavandula* contain a very high proportion of wild-collected plants, making them a key research resource in unravelling the naming and relationships of the species.

The Cambridge collection of *Lavandula*, which is especially strong in wild-collected species from the Canary Islands and North Africa, enabled the definitive monograph of this genus to be published by Dr Tim Upson and Susyn Andrews in 2004. The collection also provided essential material for the beautiful botanical reference paintings of each species by Cambridge botanical artist Georita Harriott. The collection is now being used for further research into understanding the patterns and mechanisms of variation and speciation in the genus.

The way we go about collecting plant species in the wild became more complex following the 1992 Earth Summit, in which the sovereign right of a country over its genetic resources was recognised. Collecting material for potential commercial gain, such as prospecting for new medicinal compounds or ornamentals for the nursery market, now requires agreements to ensure financial benefits are fairly shared. Crucially, however, the Convention also recognised that maintaining access to wild material for the 'common good', such as education and research, is still important.

International collaboration is now prerequisite for undertaking a collecting expedition in the field. In recent years, CUBG has run two collaborative trips – to collect poppy and crocus species in particular – both of which have enhanced Cambridge collections and enabled the sharing of expertise, for mutual benefit.

Poppy project

Collaboration with the Institute of Botany in Yerevan, Armenia, was instrumental in setting up a plant-collecting trip to the country. Through a University College scholarship, Dr Anna Asatryan from the Institute spent six weeks at CUBG furthering her research on the oriental poppy, *Papaver orientalis*, an Armenian native. In September 2005, Dr Tim Upson and Sally Petitt joined her on a collecting trip around Armenia, where many ornamentals and important economic plants like wild wheats and apricots originated.

Armenia has only recently become accessible, so the wild collections made on this trip are probably the first for 60 years. It will be interesting to compare wild material of, for example, *Achillea filipendulina*, an imposing, architectural perennial, with cultivated material to see how the garden plant has changed over time. An exciting find was *Clematis orientalis*, which is widespread across Asia and bears attractive yellow flowers in summer. However, with its creamy petals spotted purple, the Armenian version was very different and we await its flowering here in Cambridge with anticipation.

Funding the future of collecting

The expeditions to Armenia and Kefalonia were financed by the Anne and Philip Tallantire Expedition Fund. The Stanley Smith UK Horticultural Trust has also contributed vital support for the ongoing collaboration between CUBG and BBGK.

Glasshouse restoration

The Glasshouse Range at CUBG is currently undergoing a major restoration, thanks to the University's Estate Management and Building Service. The original teak structure of the 1930s has been steam-cleaned, sanded, repaired and treated with teak oil before being entirely re-glazed. Any replacement timber components have been fashioned from teak reclaimed from the redundant Shippams Paste factory in Chichester.

CUBG have taken the opportunity provided by the restoration to develop an overarching theme of 'the drama of diversity' that will see all the houses re-landscaped, re-planted and interpreted to explore how plants have evolved to survive in some of the key environments around the world – from icy mountains to oceanic islands, from desert to tropical rainforest. The Temperate House, the first to be restored and re-planted, is now home to 'Continents Apart', a display focusing on the Cape of South Africa and Southwestern Australia. Over three-quarters of all plants found growing here grow wild nowhere else on Earth.

Donarbon Ltd have generously funded the transformation with a £35,000 grant made through Evolve EB under the Landfill Tax Credit Scheme, and a key supporting grant of £5000 came from the Sustainable City programme of the Cambridge City Council.



SALLY PETITT

Plant collecting in Kefalonia

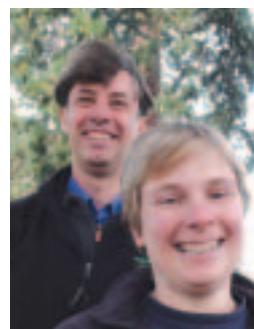
Collecting crocus

CUBG has also been involved for several years in a collaborative project with the newly established Balkan Botanic Garden Kroussia (BBGK) in Greece. In October 2006, three members of staff participated in a collecting expedition with BBGK. The primary aim was to collect autumn-flowering *Crocus hadriaticus* and *Crocus boryi* on Kefalonia for the BBGK collection.

This highly rewarding expedition yielded not only both *Crocus* species on the wish-list, but also specimens of other Kefalonian endemics including *Biarum tenuifolium* and *Colchicum parlatoris*. CUBG staff also gained valuable field experience that enhanced understanding of habitats and growing conditions for application here, and specimens of the material collected in the field will soon augment the Balkan collection on the CUBG Rock Garden.

Sharing the collection

Although collecting wild plant material has greatly changed in recent times, continued access to plants growing in their native communities remains central to the CUBG mission to maintain and develop the plant collections for future generations, and to provide access to them for research, pleasure and learning. But today it is also about sharing, not just the plants, but also the enormous expertise and knowledge within the botanic garden community, for the benefit of all.



**Dr Tim Upson,
Superintendent of the
Cambridge University
Botanic Garden, and
Sally Petitt, Garden
Supervisor**

**For more information on the CUBG,
please go to www.botanic.cam.ac.uk/**

Schnitzler's hidden manuscripts explored

Research into more than 30,000 unpublished drafts and letters casts new light on the inspirational Austrian novelist and playwright.



Arthur Schnitzler c. 1910

DORA (DORA KALLMUS)/DEUTSCHES LITERATURARCHIV MARRACH

'Schnitzler is the first great poet of the subconscious: the first writer to absorb new scientific theory about the complexity of human motive. There were others in Vienna, like Stefan Zweig, who wrote just as well, but Schnitzler still seems the most modern.'

Sir David Hare
Playwright and Director

The work of Arthur Schnitzler (1862–1931) has inspired playwrights and filmmakers, among them Stanley Kubrick, David Hare and Tom Stoppard, and was admired by contemporaries such as Sigmund Freud and Thomas Mann. Now, more than 75 years after his death, thousands of letters by the Austrian playwright are being analysed by a researcher in the Department of German.

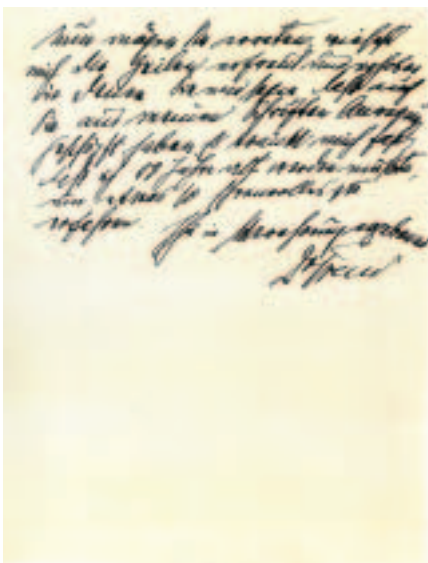
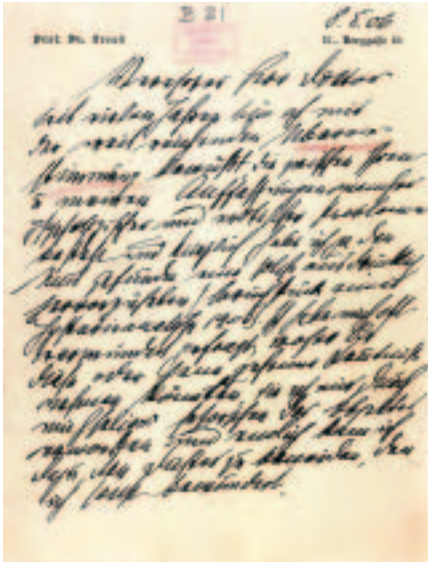
PhD student Lorenzo Bellettini has embarked on a project to study part of a vast, as yet largely unpublished, archive of Schnitzler's work. More than 30,000 pages, left behind by the Jewish writer after his death in 1931, were rescued from the Nazi book-burnings and brought to England by a Cambridge graduate, Eric Blackall, when Germany annexed Austria in 1938.

The archive – which includes Schnitzler's only surviving letter to Sigmund Freud and his correspondence with the founder of Zionism, Theodor Herzl, and offers invaluable information on his relationship with some of the leading writers and artists of his time, from Thomas Mann and Henrik Ibsen to Hugo von Hofmannsthal, Richard Strauss and Gustav Mahler – has been available to researchers ever since, but most of it has remained unread. In the meantime, Schnitzler himself has attained almost cult

status thanks partly to the way he was revered by later generations of writers for both stage and screen. His works have inspired Tom Stoppard's *Dalliance* and *Undiscovered Country*, David Hare's *The Blue Room* and Stanley Kubrick's final film *Eyes Wide Shut*.

Sigmund Freud wrote in an admiring letter to the author: 'I have gained the impression that you have learned through intuition – though actually as a result of sensitive introspection – everything that I have had to unearth by laborious work on other persons.' However, our understanding of Schnitzler himself remains distorted, due both to numerous clichés surrounding him and to our lack of knowledge on the role that some of his closest friends had in his creative process. Through researching Schnitzler's legacy, Lorenzo Bellettini aims to lift the 'translucent screen' that masks the man.

One important revelation emerging from this work sheds light on Schnitzler's debt towards his close friend and fellow-writer Gustav Schwarzkopf. Letters between the two show that Schwarzkopf suggested significant changes to several of Schnitzler's plays, some of which seem to have been incorporated verbatim, especially in the final scene of *Intermezzo* (which contains the play's entire moral message).



Sigmund Freud: Letter to Arthur Schnitzler, 08.05.1906; 'I have often wondered where you took this or that piece of secret knowledge.' MS.Schnitzler.B31

As this illustrates, a study of Schnitzler's papers inevitably goes beyond Schnitzler himself and sheds light on the world of writers around him. It is likely that comparably important revelations will be yielded from a study of Schwarzkopf's intense correspondence with another great writer and friend, Hugo von Hofmannsthal. These two correspondences *de facto* pave the way for a re-evaluation of Schwarzkopf as a key figure in the group of fin-de-siècle writers known as Young Vienna who met in the 1890s and produced some of the greatest masterpieces of Austrian and European literature.

Lorenzo Bellettini's research also makes use of diaries and letters to offer a fairer interpretation of some aspects of Schnitzler's life that have often become clichés. Schnitzler's sexuality is a case in point. The sexual themes in his work, often mirrored by his active social life, caused controversy in his own lifetime and have often dominated his reputation. Their interpretation is dangerous because in many ways it risks becoming an extension of the anti-Semitic propaganda that the Nazis devised to portray him as a lascivious Jew.

Perhaps as a consequence of this risk some researchers have been inclined to sweep Schnitzler's sexuality under the carpet to purge his image and adapt it to chaste ideals. This is, of course, also wrong, because Schnitzler's sexual life is well documented in his diaries. Between 1887 and 1892 he kept a written record of his exploits, with the sum total for every year, ranging from 208 in 1887 to over 400 in 1892. A correct interpretation of this bizarre habit becomes possible only if we see it in a larger context: Schnitzler's erotic activity being an expression of that same energy and thirst for life and culture that accounts for his extraordinary productivity. It is the same enthusiastic élan we find in his diary entries recording the mind-boggling number of his visits to the theatre, opera and concerts, as well as his extensive readings.

As a teenager in the 1870s, for example, Schnitzler was, often unbeknownst to his father (who later forced him to pursue a medical career), writing complete novels in secret – including one that exceeds 600 pages in length. At 18, Schnitzler looked back proudly at the thousands of pages of the 23 complete and 13 unfinished plays he had already written.

This same energy is evident in the cultural voracity that characterised all his life and is recorded faithfully in his diaries and letters. He profited from the cultural cornucopia that Vienna, the capital of the Austro-Hungarian empire, had to

offer, and this energy is also a constant of his travels. When he was in London in May–July 1888, the 26-year-old Schnitzler immersed himself in the capital's culture with opera, theatre, balls, concerts and soireés in society. He filled his days with recitals at the once-magnificent St James Hall and Crystal Palace and with quintessentially English operettas, such as Gilbert and Sullivan's *Pirates of Penzance* at the Savoy Theatre.

Schnitzler experienced life and culture with admirable intensity – his is the motto 'Intensivsein ist alles' (intensity is everything) – but not, however, without criticising what he saw. When, during a two-month stint in Paris in April–May 1897, he wrote to his friend Gustav Schwarzkopf about the 'Haupterfolge der Saison' (the hits of the season) at the local theatres, he enjoyed tearing most of them apart, with a splendid mixture of lightness, irony and vitriolic sarcasm.

Research into his 'hidden manuscripts' at Cambridge aims to shed light on this Schnitzler, the critical, lively, voracious, productive Schnitzler, the great 'sceptical enamoured of life' as the Austrian writer Robert Musil once called him, in an attempt to bring him closer to us in his contradictions, complexity and humanity.



Lorenzo Bellettini

To accompany the research, a travelling public exhibition showing some of Schnitzler's manuscripts from the Cambridge archive for the first time will be visiting several universities in the UK, USA and continental Europe during 2007 and 2008. The exhibition may be booked by institutions wishing to host it. For more information, please contact the author Lorenzo Bellettini (lb289@cam.ac.uk) at the Department of German, or write to him at Corpus Christi College, Cambridge, CB2 1RH.

A new 'dipstick' test meets the diagnostic needs of resource-poor settings in both worlds.

Two worlds, same needs, one solution

New generations of diagnostic tests are continually being developed for the benefit of people living in affluent nations, but the diagnostic needs of those in the poorest parts of the world, who also have the highest burden of infection, are inadequately met. The lack of resources and skilled labour has contributed to the seemingly unstoppable spread of some diseases.

At the Diagnostics Development Unit (DDU) in the Department of Haematology, the goal of Dr Helen Lee and co-workers is to deliver diagnostic tests that are rapid, intuitively simple, excellent in performance and low in production cost for the detection of infectious agents that affect the millions living in resource-poor settings.

The fruit of innovation

Several diseases have been targeted by the DDU, including chlamydia, paediatric HIV infection and hepatitis B, all of which are prevalent in the poorer regions of the world. Dr Lee's group has developed an inexpensive, sensitive and easy-to-use 'dipstick' test that detects a bacteria called *Chlamydia trachomatis*, based on a sensitive visual amplification detection technology the group has developed and patented. The *Chlamydia* bacteria cause trachoma, an eye infection spread by the Bazaar fly or through lack of hygiene. An estimated 84 million people are afflicted by trachoma, 90% of whom live in the developing world. The disease has led to blindness in 1.3 million and visual

impairment in 7 million people.

Chlamydia is also the cause of the most commonly diagnosed sexually transmitted bacterial infection in the UK, and the leading cause of infertility in women. Once diagnosed, both infections can be easily cleared by a single dose of antibiotics.

In a trial involving over 600 Masai children in Tanzania, the trachoma test proved to be more than twice as effective in detecting disease than traditional analysis. Claude Michel, the scientist who developed the trachoma dipstick test said: 'It was fantastic to be able to show the children, there and then, what we had found. If a steady purple line appeared on the dipstick, it indicated that they were infected and we could treat them immediately.' Speed of testing and treatment is crucial – it means children don't have to make the long and arduous journeys back to the testing site for treatment and it circumvents difficulties in locating those infected. In Africa, where there is just one ophthalmologist for every million people, a simple and accurate test will increase identification of infected individuals.

Dr Silvio P. Mariotti, head of the WHO Alliance for the Global Elimination of Trachoma by 2020, referred to the dipstick test as 'a very promising and interesting tool' that will 'bridge one of the biggest limitations of infection detection through laboratory means, which is that you need very complicated sampling methodology.'

Trachoma testing in a Masai tribe community

The future

Meeting the diagnostic needs of the developing world cannot be achieved in a sustainable way by altruistic efforts alone. To commercialise the technologies, a spinout company – Diagnostics for the Real World – has been set up near San Francisco. The company has two-tiered pricing: charging premium price in developed countries and at near-manufacturing cost in developing countries. Having successfully completed the UK clinical trials of the *Chlamydia* dipstick for the diagnosis of genital infections, the test recently received regulatory approval for use in European countries. Both dipstick tests will have a major health impact worldwide and meet a convergence of needs that can be summed up as 'two worlds, same needs, one solution'.



Dr Helen Lee (front, second from right) and members of the Diagnostics Development Unit

For more information, please contact the author Dr Helen Lee (hl207@cam.ac.uk) at the Diagnostics Development Unit, Department of Haematology.

Dr Chris Smith

Public engagement with science is top of Dr Chris Smith's agenda. His trailblazing approach to making scientific issues interesting, interactive and informative to the general public has gained recognition within the University of Cambridge and beyond.

Juggling his full-time role as a clinical virologist based in the University's Department of Pathology, Dr Smith is the founder of The Naked Scientists (www.thenakedscientists.com), a media-savvy group of physicians and researchers from the University who use radio, live lectures and the internet to strip science down to its bare essentials, and promote it to the general public. Their award-winning BBC weekly radio programme reaches a potential audience of six million listeners across the east of England, and also has an international following on the web. In addition to the radio show, the group has organised Naked Science at Borders, a public lecture series enabling the community to attend informative presentations given by some of the UK's most celebrated scientists.

As a recent winner of the Biosciences Federation Science Communication Award, Dr Smith's vision 'is to help people enjoy science as much as we do and, at the same time, to have fun.' Dr Smith's work with The Naked Scientists is well supported by the research sponsors, including a £400K grant from the Engineering and Physical Sciences Research Council for public engagement.

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

When I was at school I had a fantastic chemistry teacher, Mr Pockley, and biology teacher, Mr Lawrence. There you go – I can immediately remember the two people who really set me in the direction of science. They were brilliant because they were encouraging, positive and enthusiastic. Most importantly, when you asked hard questions they didn't say 'You don't need to know that', they gave you the answer. I think that's the key because if you're a curious kid and you get used to having your appetite assuaged then you continue to build on the desire to have more knowledge.

What would others be surprised to learn about you?

Despite appearing very confident on the outside, I am wracked with insecurity all the time. What I mean by that is I'm a

Dr Chris Smith (front right) with members of The Naked Scientists team



CAMBRIDGE NEWSPAPERS

worrier. I actually think it's very useful to be a worrier because you can anticipate what might go wrong and how to get around problems before they arise. It means you can steer a path through obstacles but it does make for a few sleepless nights!

Who or what inspires you?

Brilliant scientists who work really hard, make amazing discoveries and have a good sense of humour at the same time inspire me. The best lectures and talks I have attended are those given by speakers who are not only engaging but also funny. The ability to capture an audience's attention and hold them in the palm of your hand is inspiring. This is a quality I've always striven to emulate – I don't think I'm quite there yet. A sign that someone really knows their subject is if they can have fun with it at the same time as educating and entertaining people.

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

A very good friend of mine said to me 'You're only on this planet once. Life is not a rehearsal.' Up until then I'd been a 'try-and-do-everything' kind of person. I realised that life is too short and that you have to pick and choose a bit. I was finding that decision quite hard to embrace but this advice made me realise that you have to think of yourself rather than what others want you to do, say or believe all the time. That's when I began to really branch out and do things to make myself and the people I care about happy rather than do what everyone expected me to.

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

To clone myself so there would be enough of me to do all the things that I'd like to achieve. If I could clone myself, I'd also probably win a Nobel Prize, which has its benefits too!

What motivates you to go to work each day?

Quite simply, I love what I do. I'm happy to stay here all night if I have to. I'm very creative and I love making something tangible and real – something to show for what I've done. When our radio programme comes together, I know that I've done the best job I can, and the number of downloads show that people enjoy it – that's what does it for me.

What will the future look like in 2050?

I think we've probably enjoyed a golden age up until now. We had almost limitless energy in terms of fuels and been relatively free from the terror threat that is looming today. I also think the population has been smaller so the Earth's had a few more resources to go around. But by 2050 we will have probably reached crunch point and I think the world will be a very restricted place. People will think they are free but in actual fact, we'll be tied up in bureaucracy, everyone will have an ID tag and people will probably be exterminated for living too long! I think the world is better now than it will be then – I think it's going to get worse before it gets better.

The Engineering and Physical Sciences Research Council (EPSRC) is the UK's leading funding agency for research and training in engineering and the physical sciences, investing around £650 million a year in scientific discovery and innovation in the UK. Its aim is to promote and support high-quality basic, strategic and applied research across a wide range of subjects, from mathematics to materials science, and from computing to structural engineering. Complementing this, the EPSRC has recognised the importance of routes by which knowledge developed in academia can be linked – or transferred – to each other, to industry research and to commercial activity. Companies such as Plastic Logic and flagship programmes such as the Cambridge Integrated Knowledge Centre (CIKC) are impressive harbingers of the benefits of knowledge transfer.

EPSRC Engineering and Physical Sciences Research Council

The EPSRC is keen to show that its funding doesn't just benefit the academic community: collaborations with non-academic partners – usually in industry – have always been seen as vital by the Council and many research teams include non-academic collaborators. In Cambridge, EPSRC-funded academics are among the most active practitioners and advocates of so-called knowledge transfer, although not all would classify their work with collaborators in such formal terms unless it was funded under a specific scheme such as a Department of Trade and Industry EPSRC Knowledge Transfer Partnership, for example. Now, increasing efforts are being made by the EPSRC to raise the visibility of knowledge transfer arising from its funded research, and of its benefits to collaborators inside and outside academia.

In 2006 the EPSRC held its first Knowledge Transfer Challenge Awards totalling £1 million and in 2007 the Council will launch a new strategy on knowledge transfer and economic impact, outlining its vision for the next 10 years. Projects such as the CIKC and companies such as Plastic Logic, both described here, demonstrate the link between innovation and commercialisation – between research funding and wider societal benefit – by bringing the best technological expertise

together with manufacturing and business know-how to deliver the 'unmet ambitions' of industry.

On a practical level, the EPSRC will put measures in place to gain a greater understanding of the research and skill needs of business and will share that picture of the 'demand side' with academic researchers. Policies and incentives will be developed to encourage knowledge transfer and greater engagement between research and business, and successful interactions will be promoted.

The EPSRC's renewed focus on knowledge transfer takes its cue from the Research Councils UK (RCUK) report 'Increasing the Economic Impact of the Research Councils' published in January 2007 (itself a response to a Government review of the Councils' performance in 2006). Key points in the strategy include the creation of a new national forum for knowledge transfer (to be headed-up for RCUK by the Arts and Humanities Research Council Chief Executive, Professor Philip Esler); the commissioning of major studies to evaluate the economic impact of the Councils' investments; and biennial surveys to ensure that investments and activities by the Councils are aligned with the needs of users.



Plastic Logic

Plastic Logic, spun out of Cambridge University's Cavendish Laboratory in 2000, is a market leader in plastic electronics manufacturing having pioneered a method for printing electronics onto flexible plastic. The technology is based on over 20 years of fundamental research, principally funded by the EPSRC, in the laboratory of one of Plastic Logic's co-founders, Professor Sir Richard Friend FRS.

Professor Henning Sirringhaus, also a co-founder of Plastic Logic, explains some of the history of the relationship with the EPSRC: 'With the support from the EPSRC we were able to study some of the fundamental properties of polymer semiconductors, long before there was much of an application prospect. With this we improved materials performance. Once we proved printing as a route to manufacturing we were able to attract a large grant from the EPSRC to develop the technology and sort out some of the fundamental issues that we hadn't been able to address. The EPSRC funding really enabled us to understand the materials and develop them to a level where

Money matters: EPSRC and Cambridge

- The University of Cambridge currently receives funding worth a total value of £183 million from the EPSRC^a
- Current EPSRC funding totals 292 grants, awarded to 21 different departments across the University; 22% are awarded to the Dept of Engineering to a value of £53 million^a
- 19 fellowships and research chairs at the University are currently EPSRC funded^a
- The total value of EPSRC studentships at the University has grown to £5.4 million in 2005/6^b

Source: ^a EPSRC; ^b Research Services Division.

For more information about the EPSRC, please go to www.epsrc.ac.uk

CIKC CAMBRIDGE INTEGRATED KNOWLEDGE CENTRE

Advanced Manufacturing Technologies for Photonics and Electronics – Exploiting Molecular and Macromolecular Materials

Today's manufacturing processes are undergoing a major step-change, the results of which will have an impact on next-generation products on an enormous scale, from microwaves to mobile phones, solar panels to car wiring. Society-driven needs demand ever-increasing functionality and improved performance, coupled with lower costs and increased output. How are we to meet these challenges?

The EPSRC-enabled foundation of the Cambridge Integrated Knowledge Centre (CIKC) has responded by creating within the University a nucleus of the necessary skills and tools. World-class electronics research has been brought together with business management acumen, competence in manufacturing and external partnerships with industry.

'By bringing a credible team of competence together and by putting at its heart a strong scientific and technical ability, and high-quality facilities, we are unique in that we can provide the long-term opportunities that many industries cannot' explains Dr Terry Clapp, Director of the CIKC. 'The University is already an effective centre for knowledge transfer into business expression but the EPSRC funding has allowed us to take another step in that direction by coordinating these activities in a meaningful way.'

Industry is very actively involved with the CIKC management, at the urging of both the Government and the EPSRC: 'With the strategic objective of wealth creation, the direction of a significant proportion of the work will be directly influenced and determined by societal and industrial need,' says Dr Clapp.

By developing advanced manufacturing technologies, using molecular engineered polymers, advanced liquid crystals and nanotechnology, the aim of the CIKC is to enable those with exploitable concepts to achieve commercial success. A particular focus is in the emergent technology enabled by low-temperature and additive processing and how this will improve manufacturing processes of the future. The involvement of Judge Business School as a partner, with its interest in the transition from innovation to commercialisation, provides the core business skills required to do this.

Dr Clapp explains that, through the CIKC, the EPSRC and the University are 'collaborating in a flagship programme that will allow it to deliver the strategic objective set out by the Government – to show that research funding provides societal benefit.'

Cambridge-based partners within the CIKC:

Electrical Engineering Division of the Department of Engineering, and the Centre for Advanced Photonics and Electronics

Department of Physics
Judge Business School
Institute of Manufacturing



**Professor
Henning
Sirringhaus**

commercialisation became credible. That's the point when we seriously considered starting a company.'

The attractive feature of the polymer semiconductors is that they can be dissolved in an organic solvent and coated onto a substrate – realising transistor devices for applications such as 'flexible active-matrix display modules'. Electronic readers made in this way will provide consumers with an alternative to reading on laptops or on paper. In January 2007, Plastic Logic announced that it had raised £52 million of equity finance to build a production facility in Germany.

For more information on Plastic Logic, please go to www.plasticlogic.com



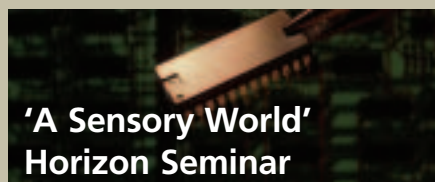
**Dr Terry
Clapp**

Ignite: CIKC links up with CfEL

CIKC has funded places worth £10,500 on the 2007 Ignite programme run by the Centre for Entrepreneurial Learning (CfEL) based at Judge Business School. The programme is for aspiring entrepreneurs among Cambridge Physics and Engineering students, with places also open to selected industrial partners. Facilitating technology transfer is core to CIKC's remit, as Mark Leadbeater, Programme Manager for CIKC, explains: 'The unique blend of teaching sessions and mentoring from leading innovators offered by Ignite will enable those with business ideas based on the new technologies being developed in the University to accelerate the next steps to commercialisation.'

Ignite will run from 8–14 July 2007 at Judge Business School, Cambridge. Further information can be found at www.cfel.jbs.cam.ac.uk

NEWS FROM RESEARCH SERVICES DIVISION



'A Sensory World' Horizon Seminar

In recognition of the multi-disciplinary research happening in and around Cambridge, the latest Horizon Seminar organised by the Research Services Division (RSD) focused on sensor technology. The rich diversity of applications being developed were showcased to over 130 delegates from academia and industry – from holographic glucose sensors in the eye, to detection of gas emissions in turbo engines and volcanic lava lakes. Dr Simon Aliwell, Director of Sensors Knowledge Transfer Network, summed up the value of the event: 'Sensing research is inherently multidisciplinary so it is often not obvious where to find it in universities. The Horizon Seminar showed just how much great innovation is going on in sensing research at Cambridge.'

For more information about the Horizon Seminar series and to book online, please go to www.rsd.cam.ac.uk/events/horizon or email horizon@rsd.cam.ac.uk

Clinical School Satellite Office for RSD

Research Services Division (RSD) has recently opened a satellite office in the School of Clinical Medicine. The office provides valuable help and advice on eligibility, grant costing and the application process for all Clinical School research staff. Dr Duncan Simpson will also be available for general advice on funding streams and to help facilitate corporate research partnerships and multidisciplinary research across the University.

Contact details and times:

(other times by arrangement)
RSD Office, Room 4023,
School of Clinical Medicine
Tuesday 9:30–12:30 (pFACT and troubleshooting)
Thursday 9:30–12:30
(general Applications queries)
Tel: +44 (0)1223 765432
Email: pfact.training@rsd.cam.ac.uk
Partnership Group contact:
Duncan Simpson
Tel: +44 (0)1223 765446
Email: Duncan.Simpson@rsd.cam.ac.uk

Former Director of Research Services honoured by the Queen

Professor David Secher, the former Director of Research Services, has been honoured by receiving the Queen's Award For Enterprise Promotion, announced on 21 April.

The prestigious award recognises people who have played an outstanding and significant role in promoting the growth of enterprise and entrepreneurial skills. During his time at Research Services Division (RSD) between 2000 and 2005, Professor Secher was responsible for more than 100 new licences and 15 spin-out companies. RSD helps academics at the University to identify, secure and manage more than £200m of research funds every year and fosters long-term research partnerships between companies and academics for mutual benefit.

Professor Secher, now Chief Executive of Sheffield-based N8, has been involved in enterprise promotion for over 30 years and has done much to influence the culture shift towards commercialisation by UK universities.

NEWS FROM CAMBRIDGE ENTERPRISE LTD

Lumora: how a firefly sparked a solution to food safety

Food safety is a growing problem. The number of reported food poisoning cases in the UK has increased in the past 25 years from 23,000 to 80,000 cases annually. There are several contributing factors such as a wider choice of 'ready-made' meals with shorter shelf-life, as well as longer produce-shipping times and growing food intolerances.

From a young age, Laurence Tisi had an interest in both chemistry and biology, which led first to studying biochemistry at the University of Bristol and then to a PhD at the Department of Biochemistry in Cambridge. From here, he joined the Institute of Biotechnology in Cambridge, to work with Professor Jim Murray. He found the Institute created an entrepreneurial atmosphere in which the academics are exposed to many different ideas and technologies. As Dr Tisi explains:

'this atmosphere was important as innovations often come from recognising how very different technologies can fit together.' The result is a company called Lumora.

Lumora has created a revolutionary new food safety diagnostic system, capable of quickly and cheaply detecting and identifying pathogens such as *Salmonella*. The technology developed can even detect growing levels of what has been dubbed 'food fraud'. For example:

- whether the food contains genetically modified material;
- from which company the genetically modified material originated;
- whether a bottle of olive oil comes from Greece or Spain;
- whether the barley purchased at great expense is really fit for brewing or only fit for animal feed!

So where does the firefly fit in this story? Lumora has developed a novel technology that means any specific DNA sequence can be detected by recording light coming from a modified version of luciferase – the enzyme responsible for the bioluminescence of fireflies. Uniquely, the light is produced in real-time as the DNA is detected, making the test very rapid, quantitative, easy to use and capable of building into a hand-held device. The technology came from one of those

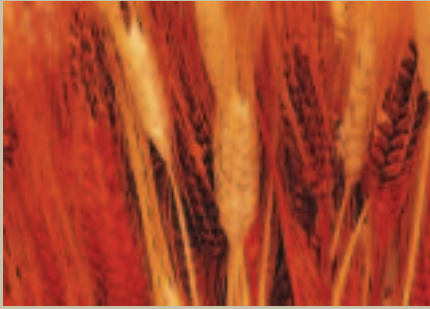
'eureka' moments, where it was realised that two completely unrelated biochemical methods could be combined to give a whole new technology.

The company was founded in 2003 as a spin-out from the University of Cambridge. Cambridge Enterprise Seed Funds and a consortium of private European Union financiers were the initial investors. In July 2006, Lumora announced the signing of a key licensing deal with the global diagnostics company bioMérieux, based in Lyon, France. This deal allows Lumora to combine its unique luminescent technology with a DNA amplification detection technology from bioMérieux. In January 2007, Lumora became the first company to receive investment from the newly created food sector focused venture fund, Tate & Lyle Ventures.

Having realised that their technology was perfect for the growing diagnostic needs of the food industry, Lumora is now working on the next generation of prototypes that will be available in the next year for a range of food sector companies. The novel detection technology is highly sensitive, extremely rapid and, most importantly, versatile and affordable.

For more information, please go to www.lumora.co.uk

FORTHCOMING EVENTS: SAVE THE DATES!

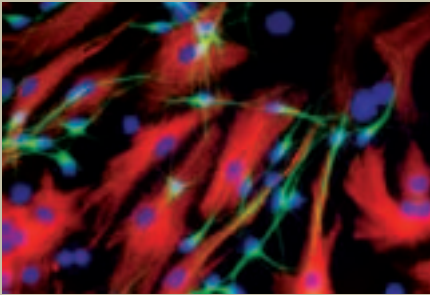


19 June 2007

Horizon Seminar

'Foodomics? Why we eat, what we eat, and what's next 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. See page 8 for more details.



PROFESSOR CHARLES FRENCH-CONSTANT

19–21 September 2007

Cambridge Neuroscience Launch Symposium

Cambridge Neuroscience is the University's new initiative to promote multidisciplinary research across themed areas of neuroscience 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. For more details, contact Dr Danielle Turner, Cambridge Neuroscience Coordinator (coordinator@neuroscience.cam.ac.uk) or go to www.neuroscience.cam.ac.uk

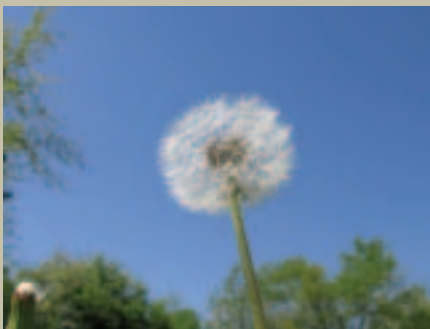


10 October 2007

Horizon Seminar

'Energy in Cities: 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 the security of energy supplies. Cities and regions have both a responsibility to reduce their carbon emissions and the opportunity to take advantage of new energy-efficient systems and renewable energy. At this Horizon Seminar, leading experts will describe their ground-breaking research in energy use in built environments, clean and efficient urban transport and renewable energy generation in cities. Please note that this event will now be held at Buckingham House, New Hall, Cambridge.

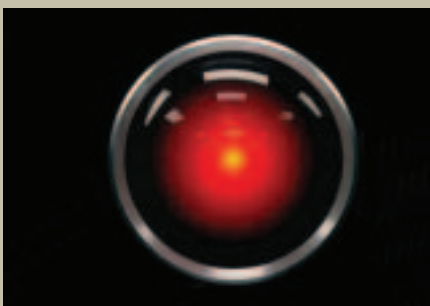


4 December 2007

Horizon Seminar

'Live Long and Prosper? Ageing in the 21st century'

Because of health improvements in the last century, many developed societies are experiencing increased longevity and its consequences. In Europe, people older than 80 now represent the fastest-growing age demographic. 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 opinions of leading academics from Cambridge and beyond at this Horizon Seminar to be held at the Centre for Mathematical Sciences, Cambridge.



18 March 2008

Horizon Seminar

'The Thinking Machine?'

Our understanding of the process of cognition in human beings – how we perceive, think and process information about our environment – is highly developed. This Horizon Seminar will explore cross-disciplinary research on cognisance and cognitive systems, including cognitive psychology, neuroscience linguistics, philosophy and computer science. As the disciplines converge, what will we learn about the extent to which man is a machine or whether a sentient machine can ever be developed? This Horizon Seminar will be held at Emmanuel College, 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 or email horizon@rsd.cam.ac.uk

We are looking for article ideas for Issue 4 of Research Horizons and welcome suggestions from all areas of research across the University. Please send suggestions to the Editor at:
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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