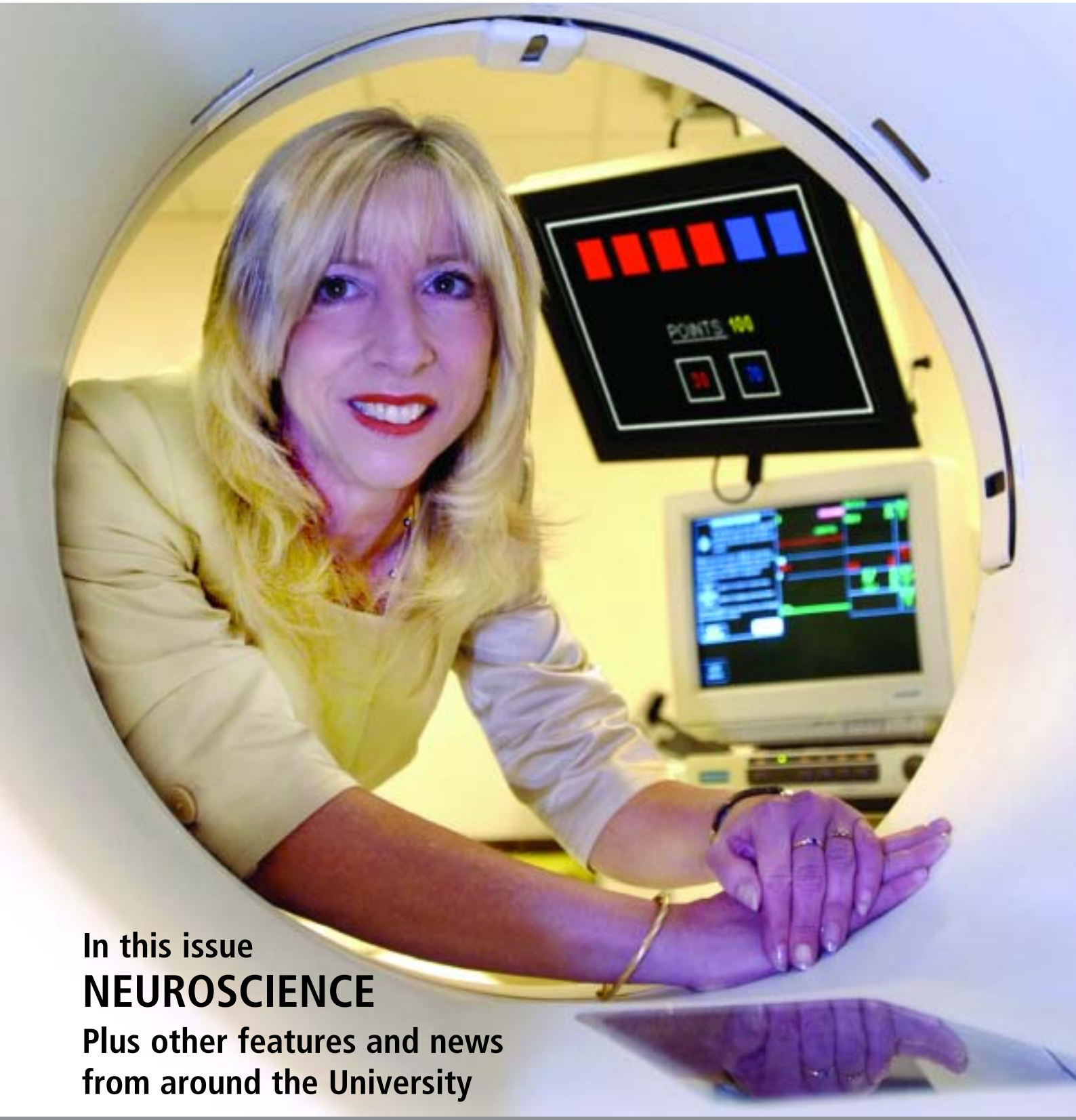
RESEARCH HORIZONS



In this issue

NEUROSCIENCE

Plus other features and news from around the University

The research magazine of the University of Cambridge
www.rsd.cam.ac.uk
Issue 1 | October 2006

UNIVERSITY OF CAMBRIDGE

Foreword

Welcome to this first edition of Research Horizons. Cambridge is a research led university and this magazine provides a snapshot of just a small selection of the world-class research that is currently being undertaken across the University and its associated institutions. Cambridge has been home to scientific and medical breakthroughs for centuries, but as you will see, we are also home to ground-breaking research in the arts, humanities and the social sciences.

The University's Research Services Division supports the thousands of research programmes across Cambridge, and as part of that support, it promotes a series of Horizon seminars, bringing the latest thinking from academics and business people to a wider audience. This edition focuses on current research in neuroscience, the subject of a Horizon seminar on 12 October, and previews some of the latest scientific approaches to combating terrorism with security and threat detection. The latter forms the basis of the next Horizon seminar on 5 December.

Whatever your interests, we hope that this magazine gives you an insight into how research at Cambridge is changing the world. If you would like to find out more about any of the stories, follow the web links at the end of each article or contact us at www.rsd.cam.ac.uk

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www.cambridgeprinting.org

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Nations in debt – weakness or strength?

A common assumption today is that heavily indebted states, particularly in the developing world, are signing away a large part of their sovereignty.

But the historical record suggests that indebtedness is often a means for states to assert their sovereign power, either though their ability to sustain those debts or though their ability to renege on them.

The Cambridge Sawyer Seminar is a year-long project funded by the Mellon Foundation, which will bring together historians, economists, lawyers and political theorists to explore the relationship between public debt and political power. The question at the heart of this project is whether debt weakens or strengthens states.

The project will examine what the history of state debt implies for the future prospects of the world's most powerful and most heavily indebted states like the US, and what it tells us about the plight of some of the weakest, in Africa and elsewhere. Standard responses to the issue of state debt tend to take a moral stance or focus on highly technical analysis, but historical perspective is often missing.

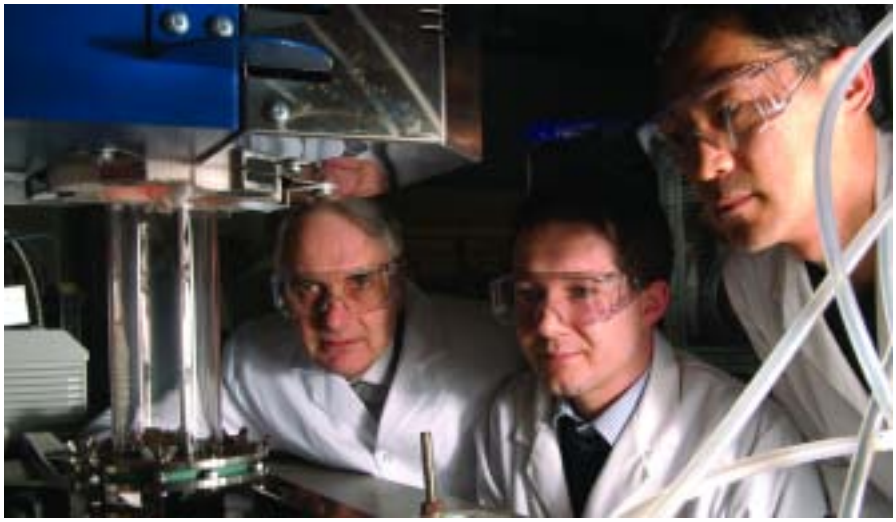
The seminar encompasses a series of historical workshops over the course of the academic year, and a conference in September 2007 that will identify any historical lessons which can inform today's world picture. The workshops, which begin in November 2006, will look at subjects such as the role of debt in the power politics of the medieval Italian city-states, the relationship between debt and democracy in the founding of the Bank of England, the role of debt in the funding of empire in the nineteenth century, and the relationship between debt and dictatorship in the first half of the twentieth century.

The seminar program will also include a series of open lectures during the academic year 2006-7 to highlight themes of the project: The first of these, on 12 October, will be given by James Macdonald, author of *A Free Nation Deep in Debt: the Financial Roots of Democracy*.

www.sps.cam.ac.uk/pol_sawyer.

Nano breakthrough in next-generation manufacturing

Carbon nanotubes are one of the basic building blocks of nanotechnology, but using nanotubes in manufacturing has challenged scientists across the globe.



Now, Cambridge scientists have made two significant breakthroughs in the applications of carbon nanotubes.

Firstly, there is a new ability to manufacture at low temperatures, with big implications for the next generation of electronic devices such as mobile phones and computers. Previously, the production of nanotubes has involved growing them at 500° C, and production below this temperature was thought impossible. A group at the University of Cambridge have successfully grown them at 350° C which means the nanotubes can now be directly integrated into new-generation electronics.

Growing at higher temperatures would damage the inter-metal dielectrics (an electrical insulator) used to make electronic devices. But at these new low temperatures, the nanotubes could be used in niche applications and in miniaturised, more efficient versions of everyday electronics.

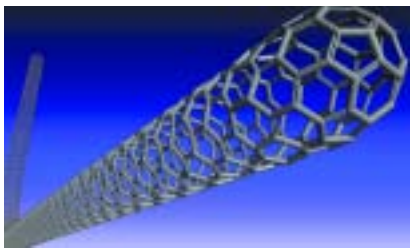
The advantage of making materials from nano substructures only one ten thousandth of a millimetre across, is that the properties of a material change as its components get smaller; for example, isolated carbon nanotubes are stronger than any material known to man. The challenge is to assemble them into a fibre so as to exploit these properties.

In the second breakthrough, Cambridge scientists have learnt how to make the nanotubes and turn them into a high performance fibre in one cost-effective operation. This time, using a particularly high temperature, nanotubes form as a smoke which is elastic, a bit like candy floss, so it can be grabbed and wound continuously to make the fibre.

The strength and stiffness of these fibres combined with their low density means that they can be mixed with a polymer to form composites, useful in cars and aeroplanes that require high strength but low weight to save fuel. Composite fibres made from nanotubes may replace graphite fibres in Formula One cars, but, because they are cheaper, eventually find their way into the family car too.

The research was conducted at the Department of Engineering, the Cambridge Hitachi Laboratory and the Department of Materials Science.

www.msm.cam.ac.uk/polymer
nanotubes@msm.cam.ac.uk



Naontubes are made of a type of carbon known as Buckminster fullerene (or buckyballs) which was discovered in 1985. Fullerene is composed of football-shaped cages, which are formed into a hollow ball structure. Nanotubes are hollow tubes with a width of one millionth of a millimetre, and are up to one millimetere long. They contain carbon atoms arranged in sheets which are rolled together to form a cylindrical tube. They can be single (one tube) or multi-walled.

First time buyers in the spotlight

In the mid 1980s, the median age of people expected to be able to become property owner-occupiers was 25.

Short-term housing demand has driven this age well in to the early thirties and is also affecting the ability of key workers to find housing.

Cambridge's Centre for Housing Planning Research is working with the Housing Corporation on a project looking at the demographic, economic and spatial impact of demand for affordable housing. The project is a longitudinal study that will assess how the life course of individuals affects their housing needs and will help inform the future housing strategies of government, regional development agencies, and local authorities

The Centre for Housing Planning Research is a multi-disciplinary group including geographers, economists, architects and social scientists from across the University. Since it was formed in 1995, the Centre has attracted over £10 million in external research grants, carrying out over 100 research projects for a variety of sponsors, ranging from the Office of the Deputy Prime Minister, the Welsh Assembly, the Housing Corporation, the Joseph Rowntree Foundation, and a wide range of other bodies including Regional Assemblies, local authorities and housing associations.

www.cchpr.landecon.cam.ac.uk/

Twinkle, twinkle

– a step forward for radio astronomy

Radio Astronomy observations are usually made interferometrically with paired antennas: interference between the signals allows astronomers to make detailed images of the sky. A big problem for radio astronomers is the difference in phase between signals received at each antenna. This can cause the radio equivalent of the 'twinkling' that can be seen in stars, particularly on a warm night, and is caused mainly by fluctuations in the water vapour content of the atmosphere.

The Astrophysics Group at the Cavendish Laboratory have developed a unique technique to overcome this problem by using a spectroscopic characteristic of the water vapour itself to correct the effects of the turbulent atmosphere. It works especially well in scenarios where the water vapour density is quite low, making it appropriate for use at high-altitude sites where most radio-telescopes are situated.

The Group has received funding from European Southern Observatories (ESO) to support its development of a bespoke sensor system to test this technique and is currently putting it through its paces in Mauna Kea, Hawaii, where the system will sample hundreds of hours of atmospheric data and will be used to derive a better understanding of the effects of atmosphere on radio measurements. The system will eventually be used on the ALMA international radio astronomy facility situated at an altitude of 17,000 feet in the Atacama Desert of northern Chile.

The Astrophysics Group carries out research in several areas of radio astronomy, in particular the study of molecular gas clouds, galaxy evolution and the cosmic microwave background radiation; in addition, it works on the development of optical interferometry techniques.

www.mrao.cam.ac.uk/

Cambridge firm wins UK Bio Entrepreneur of the Year Award

A University of Cambridge spin-out company has been named as one of the UK's best new biotech innovators at the Bio Entrepreneur of the Year Awards hosted by UK Trade & Investment and London First.

Cambridge company Domantis received the UK Innovation in Drug Discovery and Development Award, in recognition of their contribution to the UK's dominant position in the development of new medicines.

Domantis, which was formed as a spin-out from the University's Laboratory of Molecular Biology in 2000, is a drug discovery company developing the next generation of antibody molecules – Human Domain Antibodies. Domain Antibodies (dAbs) are therapeutic molecules that have benefits of both small molecules and conventional antibodies.

Like small molecules, dAbs are highly stable, resulting in a choice of therapeutic formats, delivery formulations and manufacture options. And like human antibodies, dAbs can be designed to have specificity and high affinity with the biological target of interest.

Domantis has more than a dozen proprietary Domain Antibody therapeutic programmes primarily in the fields of inflammation and oncology and will start taking its own products into clinical development in 2007.

www.domantis.com

A new home for Human Evolution

Genetics, primate social evolution, determining how far thought processes are connected to language, how 'Out of Africa' migration patterns might look in ten years time, and putting flesh on the bones with computer-assisted technology.

L-R: Marta Mirazón-Lahr (Director of the Duckworth Laboratory), Alison Richard (Vice-Chancellor), Robert Foley (Head of Biological Anthropology), and Richard Leakey outside Evolutionary Studies' new building

These were just some of the topics under discussion when leading evolutionary scholars from around the world met in Cambridge earlier this year to celebrate the official opening of the Leverhulme Centre for Human Evolutionary Studies.

Chief among them was the renowned anthropologist and conservationist Richard Leakey whose expeditions in Kenya's Turkana basin have yielded the most important fossil finds yet in the struggle to understand the origins of the genus *homo* and early evolution.

Part of the Department of Biological Anthropology, the Centre for Human Evolutionary Studies was established at Cambridge in 2000 to create an international centre of excellence in which boundaries between disciplines did not hinder attempts to solve scientific conundrums. Funding for their major collaborative project on human evolution and development was provided by the Leverhulme Trust, while the University, HEFCE and the Wellcome Trust financed the Centre's new dedicated building in Fitzwilliam Street. In recognition of this, the Centre was renamed the Leverhulme Centre for Human Evolutionary Studies (LCHES) in 2001 and its new home was christened the Henry Wellcome Building.

The building provides ample space for a seminar room, academic offices, PhD study areas, state-of-the-art laboratories, and secure storage space for the Centre's Duckworth Collection, one of the world's largest reserves of human biological materials.

The Cambridge University Botanic Garden

The Cambridge University Botanic Garden holds the research and teaching collection of living plants, which now number over 8,000 plant species, along with the Cory Library of 11,000 volumes, an invaluable botanical reference source, and a Herbarium of plants grown in the Garden.

Opened in 1846, the Garden boasts flamboyant glasshouses of tropical plants, delicate alpines on the Rock Garden, the unique Systematic Beds, the best arboretum in the East of England and fabulous herbaceous plantings throughout. Seasonal highlights include the Dry Garden, the Autumn Garden and the exceptional Winter Garden.

While the Botanic garden is first and foremost a research resource, the Garden, shop and café are open to the public every day from 10am, admission is £3. A programme of courses and events runs throughout the year.
www.botanic.cam.ac.uk

Missing genetic information key to severe learning disorders

Scientists have discovered a genetic anomaly responsible for severe learning difficulties.

Using a new technique for detailed examination of human chromosomes, researchers at the Wellcome Trust Sanger Institute in Cambridge have identified a missing piece of genetic information which they believe may be a common cause of learning difficulties.

"It seems that people with some forms of severe learning difficulties have a small, but important section of chromosome 17 missing, which appears to have been deleted during meiosis, the process by which the egg and sperm are produced," explains Dr Charles Shaw-Smith, a Department of Medical Genetics researcher based at the Institute.

"The deletion occurs in a region of the genome known for its complexity of organisation, and also for its association with neurodegenerative disorders. However, this is the first time that the region has been associated with learning difficulties in children."

During meiosis, chromosomes are copied before lining up to exchange material. However, if the copying mechanism goes wrong, the chromosomes line up out of synch and the genetic material gets mis-paired. Dr Shaw-Smith likens this to lining up the buttons and holes wrongly on a shirt so that they don't pair up properly. It is during this process that genetic material can get deleted.
www.cimr.cam.ac.uk/medgen/

Neuroscience – breaking down the barriers

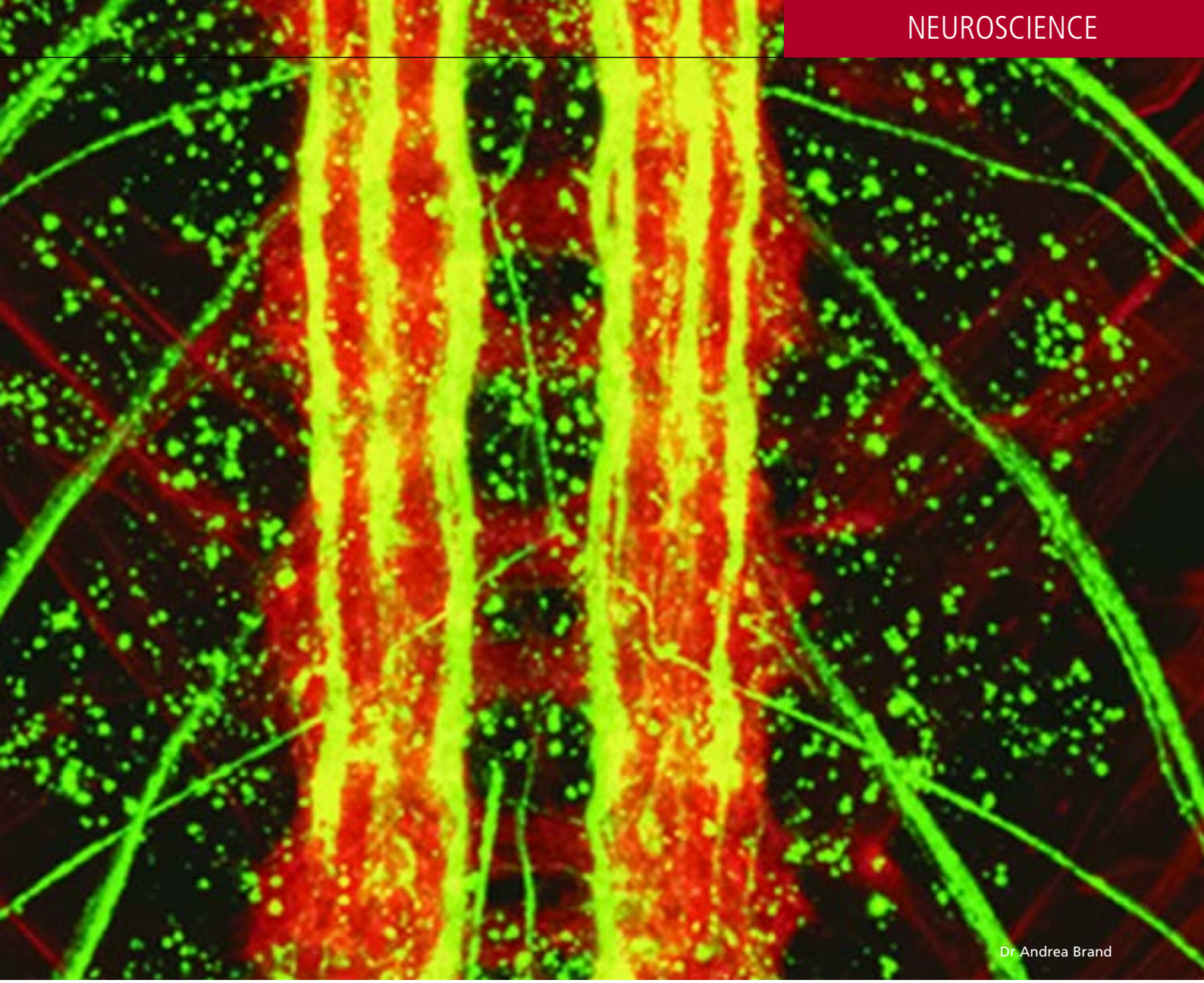
The most challenging problems in clinical science and basic research will only be cracked by a concerted multidisciplinary attack. Neuroscience – the study of how the brain and nervous system functions in health and disease – is one of them. It is the target for a new collaborative initiative at the University of Cambridge called Cambridge Neuroscience.

Through new collaborations, researchers are developing our understanding of the nervous system in health and disease and identifying new treatments for neurological and psychological disorders affecting people of all ages. Work at the School of Clinical Medicine and in the School of Biological Sciences falls into major neuroscience research themes covering basic and clinical science and their interactions.

These have been extended by the creation of novel intellectual partnerships across departments including mathematics, engineering, computer science and nanotechnology. Further expansion of the research community of neuroscientists in Cambridge will integrate neuro-physics, neuro-philosophy, social-neuroscience, neuro-economics and neuro-ethics to increase our understanding of neurological disease.

A major focus of Cambridge Neuroscience is the clinical application of basic research to conditions such as multiple sclerosis, Parkinson's, Huntington's and Alzheimer's diseases, together with autism and Asperger's syndrome and other neurodevelopmental disorders in children. There is also cross-disciplinary work on the molecular, neurochemical and neuropsychological effects of drug addiction, as well as in neuropsychiatric disorders such as schizophrenia and depression. There is a particular emphasis on cognitive enhancement through a range of treatments: research addressing the repair mechanisms of the nervous system following physical trauma, such as head injury or stroke, forms another major theme.

The University lies at the heart of a broader research and industry community with keen



Dr Andrea Brand

interests in neuroscience, based in Cambridge and the surrounding areas. This includes the internationally recognised research centres at the Sanger Institute, the MRC Laboratory of Molecular Biology, the MRC Cognition and Brain Sciences Unit and the Babraham Institute as well as many biotechnology, pharmaceutical and information technology companies. It is the formation of research links and collaborations between these centres that complements the other activities of Cambridge Neuroscience. There is a clear developmental pipeline from basic science to applied clinical research that draws on these industry and research centre partnerships. Through this, Cambridge Neuroscience is creating new intellectual property and products that lead to tangible deliverables of benefit to society.

www.psychol.cam.ac.uk/pages/research.html

NOBEL WINNERS AT CAMBRIDGE

- Cambridge has a strong tradition of world-leading achievements in neuroscience by scientists working across a wide range of research interests, and recognised by the award of several Nobel prizes for physiology or medicine.
- The 1920s saw the first analyses of neural signalling by **Bryan Matthews** and **E D Adrian**, the latter being awarded a Nobel prize in 1932. The determination of the laws that govern the movement of ions in a nerve cell during an action potential by **Alan Hodgkin** and **Andrew Huxley** in the 1950s gave scientists a basic understanding of how nerve cells work and earned them the 1963 Nobel prize for Physiology or Medicine.
- Around the same time, **Marthe Vogt** identified noradrenaline as a transmitter in the communication between cells of the central nervous system and facilitated a revolution in the treatment of mental illness while in the 1960s **David Marr** and **Horace Barlow** made some of the early theoretical approaches to the function of neural circuitry.
- More recently, **Sydney Brenner** (working with John Sulston and H. Robert Horvitz) applied genetic analysis to cell division working in the nematode worm, *C. elegans* to solve the problems of nervous system development and function and was awarded the 2002 Nobel prize.

Cognitive enhancement: on the frontline of neuropsychiatry

Major psychiatric disorders are extremely common and their effects on behaviour, perception, emotion and cognition constitute an enormous contribution to worldwide disability.

Numerous disorders, such as attention deficit hyperactivity disorder (ADHD), schizophrenia, frontal dementia, Alzheimer's, Huntington's and Parkinson's diseases are characterized by cognitive impairments. Patients frequently struggle with many everyday activities requiring concentration, memory, problem-solving and planning. The potential public health benefit of improving current treatments for cognitive disabilities in patients is undisputed.

The disorder of schizophrenia provides a particularly good illustration of the potential benefits to be had from exploring new options for the treatment of cognitive dysfunction. It is estimated that 24 million people worldwide suffer from schizophrenia, with the condition ranking third in terms of the global burden of neuropsychiatric conditions, following depression and alcohol dependence.

The economic impact alone of the disorder is enormous: in the United States the direct and indirect costs of schizophrenia were estimated to have been as much as $40 billion in the year 2000. In many patients with schizophrenia, cognitive difficulties are the main factor limiting full rehabilitation – such as returning to work – and quality of life, particularly after the clinical symptoms have remitted.

Indeed, it has been proposed that in certain patients with schizophrenia even small improvements in cognitive functions, such as enhancing the ability to adapt efficiently to new situations and to plan effectively, could help patients make the transition to independent living outside a psychiatric institution. The relatively recent shift in clinical emphasis, away from a restricted targeting of the more overt psychotic symptoms of this disorder, serves to emphasize the debilitating long-term effects that cognitive impairments can have, and the need to identify effective treatments.

Professor Barbara Sahakian's laboratory has had extensive experience with proof-of-concept studies in cognition enhancement.

Research on cognitive enhancement at the University of Cambridge.

A major problem in patients with schizophrenia, including those with first episode psychosis is the lack of cognitive flexibility in problem solving, which impacts on their ability to adapt effectively in daily life. Evidence suggests that impaired cognitive flexibility may be a marker of disease progression since it may deteriorate over time despite antipsychotic medication, and relates to duration of untreated psychosis. Recent research shows that patients with schizophrenia given the cognitive enhancer modafinil significantly improve in terms of their cognitive flexibility so that their performance is similar to that of healthy volunteers.

In addition, it has been demonstrated that modafinil is able to improve impulsive behaviour in adults with attention deficit hyperactivity disorder and even improves aspects of memory and executive functions such as planning in healthy volunteers. Similar results have also been demonstrated in patients with ADHD and frontotemporal dementia and healthy volunteers using methylphenidate. PET neuroimaging has shown that the improvement demonstrated with methylphenidate on executive tasks such as strategic working memory are associated with increased efficiency in the frontal and parietal neural network activated during strategic working memory performance.

Professor Barbara Sahakian's laboratory has had extensive experience with proof-of-concept studies in cognition enhancement. Indeed, her early research demonstrated the feasibility of treating the problems in attention and concentration in patients with mild and moderate Alzheimer's disease with cholinesterase inhibitors which have formed the basis for current treatments. More recently the laboratory has turned its focus on early detection of mild cognitive impairment (MCI) and Alzheimer's disease with a view to assessing novel cognitive enhancers and neuroprotective agents.

This work will utilise clinical neuropsychology, cognitive psychopharmacology and neuroimaging to devise early outcome measures to short-cut the drug development process for the pharmaceutical industry. Hopefully this will allow for novel effective symptomatic treatments and neuroprotective agents to become available to patients much faster. Currently there are ongoing studies using modafinil to enhance cognition in neurosurgical patients, Huntington's disease and depression. Studies about to begin include first episode psychosis, mild cognitive impairment and mild Alzheimer's disease.

A paper published recently in *Science* examines research to determine the effects on cognition of novel treatments for ADHD, such as Atomoxetine. This is currently an ongoing focus of PET neuroimaging studies at the Wolfson Brain Imaging Lab alongside investigating non-pharmacological means of enhancing cognition, such as neurocognitive activation.

www.psychiatry.cam.ac.uk/

Training tomorrow's neuroscientists

The Cambridge Neuroscience environment is ideally suited to these studies in the Medical Research Council (MRC) priority area of dementia and it provides an excellent training environment for young scientists and clinicians. The unique facilities available to these young scientists include the Wolfson Brain Imaging Centre, the Wellcome Trust Clinical Research Facility, the Cambridge Institute for Medical Research, the Behavioural and Clinical Neuroscience Institute jointly funded by the MRC and Wellcome Trust and the MRC Cognition and Brain Sciences Unit.

A recent PhD student, Dr Danielle Turner, who completed her thesis, entitled 'Psychopharmacology of cognitive enhancement', in 2005 was one of five young British Scientists to participate in the 'Celebrating British Science' event co-hosted by The Royal Society and the Department of Trade and Industry in March this year and was the winner of the 2005 Award from the British Psychological Society for outstanding doctoral research contributions to Psychology. Dr Turner held an MRC Research Studentship and the work was funded by the Wellcome Trust.

Stem cell solutions in MS research

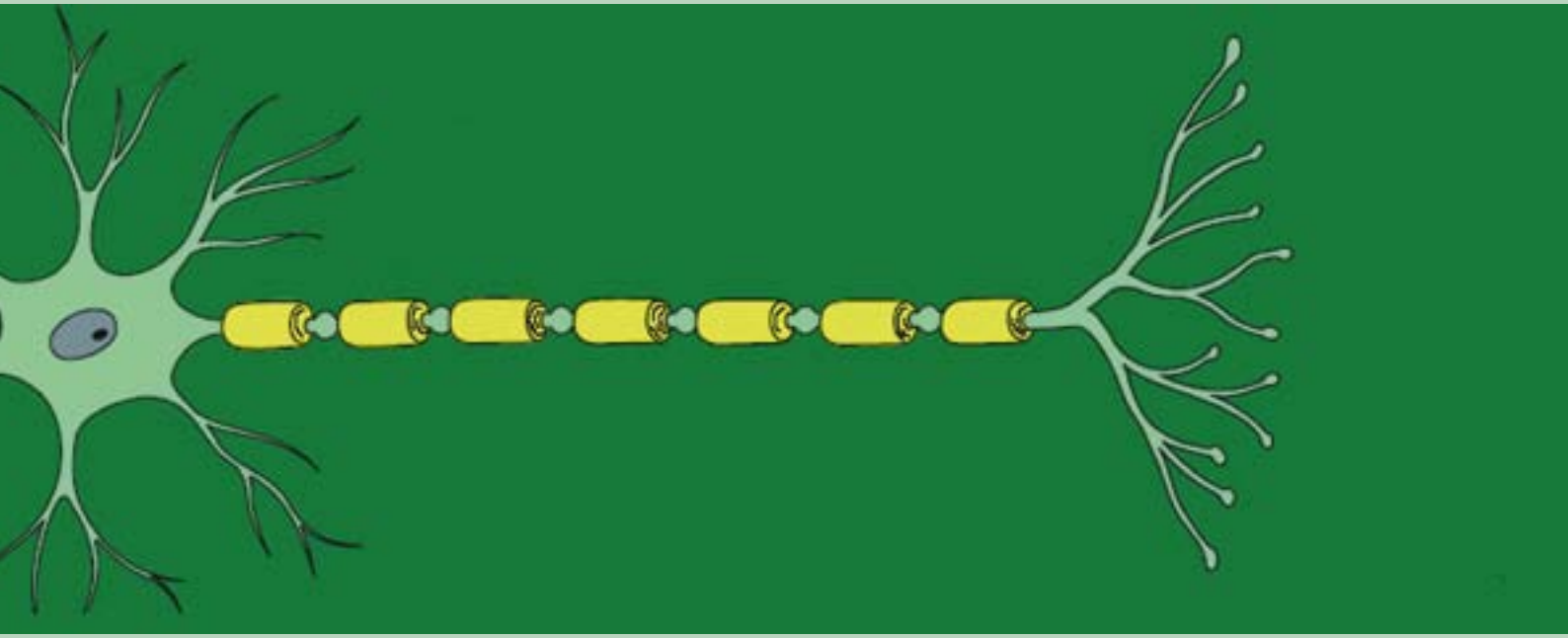
Multiple sclerosis (MS) is the commonest cause of acquired neurological disability in young adults and is characterised by loss of both nerve fibres and their surrounding protective or insulating protein called myelin.

There are presently no reparative treatments for MS. One approach in the search for a treatment for MS is the use of stem cells to produce healthy new nerve cells and researchers at the Department of Clinical Neurosciences are aiming to do just that.

Their research involves both embryonic and adult stem cells. Human embryonic stem cells are unique on account of their ability to generate all cell types of the body including nerve cells. Researchers are also studying adult human stem cells (skin or bone marrow). One of the advantages of adult stem cells is that they avoid the risk of rejection because they can be taken from the patient.

Increasing evidence suggests that stem-cell-based therapies may be helpful for MS sufferers not only because they may make new nerve cells, but because stem cells can function as cellular reservoirs of growth or nutrient factors and also modulate the body's immune response. The latter is an important consideration for a disease such as MS that is caused to a large degree by an abnormal immune response.

www.brc.cam.ac.uk/index.html



Ten year target for MS treatment

Researchers at the Multiple Sclerosis Society's Cambridge Centre for Myelin Repair believe they could be trialling a treatment for multiple sclerosis within ten years.

Multiple sclerosis (MS) is the most common disabling neurological condition affecting young adults. Around 85,000 people in the UK have MS. For some people, MS is characterised by periods of relapse and remission while for others it has a progressive pattern. For everyone, it makes life unpredictable.

In MS, myelin – a fatty protein that insulates axons, the long extensions of nerve cells – is damaged causing disruption to the messages to and from the brain. This results in a variety of symptoms. Repairing this damage and preventing further permanent damage means that symptoms can be relieved and progression of disability can be prevented. Although other treatments exist to limit myelin damage, there are currently no therapies available to *repair* myelin in people with MS. Research at Cambridge aims to change this.

The research programme is divided into three phases: understand, test and trial. The Cambridge team feel that phases one and two will be significantly advanced within five years and that within ten years they could be trialling a treatment. The work will be carried out in collaboration with two other projects funded by the Multiple Sclerosis Society (www.mssociety.org.uk) at the Institute of Neurology's magnetic resonance imaging scanner unit and the MS tissue bank at Imperial College, London.

www.brc.cam.ac.uk/

Alzheimer's: working with drosophila

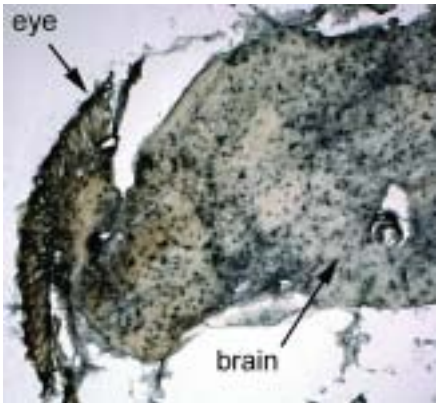
Above: A scanning electron micrograph of a fruit fly (actual size 2 mm long).

There are over 15 million people suffering from Alzheimer's disease globally and the current cost to the economy represents at least one per cent of gross national product.

Modern medicine and the science of public health have improved the lot of the Common Man and his life expectancy is gradually increasing. While this is to be commended, it has several unfortunate consequences; arguably easiest to solve is the pensions crisis, more difficult to combat is the threat of neurodegenerative diseases. Alzheimer's is the most common of these, causing up to half of all cases of progressive cognitive decline or dementia.

Medical research in the 21st century seeks to understand disease at the molecular level; by identifying the molecules that cause disease, and by understanding their interactions, it is most likely that we will be able to design new therapeutic interventions. This discipline of molecular medicine has yielded up a specific peptide (a small protein, called Aβ) that accumulates in patients with Alzheimer's disease. A highly ordered molecular process of Aβ aggregation and deposition in the brain results in the death of neurones and the consequent loss of cognitive function. However the identification of Aβ as a molecular culprit has not yet brought with it a raft of new drugs. Therapies aimed at preventing the production of the Aβ peptide have been dogged with problematic side-effects and for this reason the pharmaceutical companies (we are collaborating with Merck & Co. Inc) need fresh drug targets. We are tackling this problem by making a model of Alzheimer's disease in the fruit fly (Drosophila melanogaster) by giving the fly the gene for the human Aβ peptide. The flies produce the toxic peptide in their brains and suffer consequences that resemble the human disease. As the Aβ peptide accumulates in flies' brains we see behavioural deficits (the flies do not climb up their tubes normally) and their life span is foreshortened. We can even show that the flies have a poor memory – one of the characteristics of the human disease. Working with Drosophila allows us to perform powerful genetic experiments. In particular we have used a library of 3,000 randomly-mutated fly lines to find out which genes when turned on, or off, can make the fly resistant to the toxic effects of the Aβ peptide. We have done this screening experiment and now have a list of 21 genes that, when turned on, protect the fly from Alzheimer's disease. Some of the genes are well known and provide reassurance that the fly is reflecting the known toxic processes that occur in Alzheimer's disease. Other genes are novel and it is these "hits" that provide the hope for new therapies.

Although the fly has only 14,000 genes (as compared to the human's 40,000) a survey of the literature shows that about 75 per cent of disease-causing genes in humans have a direct insect equivalent. We are now taking our research out of the fly and using cell culture to verify that the human equivalents of the fly genes are also effective at protecting human cells. It is our expectation that drugs mimicking the effects of these genes will provide the next generation of therapies to halt the relentless progression of Alzheimer's disease.



A section through the eye and brain of an Alzheimer's fruit fly. The black spots are deposits of the toxic human Aβ peptide.

Dr Damian Crowther

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A move towards understanding

Professor Daniel Wolpert at Cambridge's Department of Engineering has been awarded a Wellcome Trust Programme Grant to study the computations the brain performs when controlling our movements.

Movement is the only way we have of interacting with the world, whether foraging for food or attracting a waiter's attention. All communication, including speech, sign language, gestures and writing, is mediated via the motor system. Taking this viewpoint, the purpose of the human brain is to use sensory signals to determine future actions.

However, the effortless ease with which we move our arms, our eyes, even our lips when we speak, masks the true complexity of the control processes involved. This is evident when we try to build machines to perform human control tasks. While computers can now beat grandmasters at chess, no computer can yet control a robot to manipulate a chess piece with the dexterity of a six-year-old child. Therefore understanding brain processing could lead to dramatic improvements in technology.

A major area of Wolpert's research programme is to understand how the brain deals with uncertainty inherent in the world and in our own sensory and motor systems. For example, our only access to knowledge about the world is through our senses which provide information that is usually corrupted by random fluctuations, termed noise, which lead to variability in our perception – try localising your hand when it is hidden under a table. In addition sensory inputs may provide ambiguous information about the possible states of the environment – you can't tell if a teapot is full or empty just by looking at it.

Professor Daniel Wolpert

Image: Nature magazine

Moreover, when we act on the world through our motor system, the commands we send to our muscles are also corrupted by variability or noise that leads to inaccuracy in our movements.

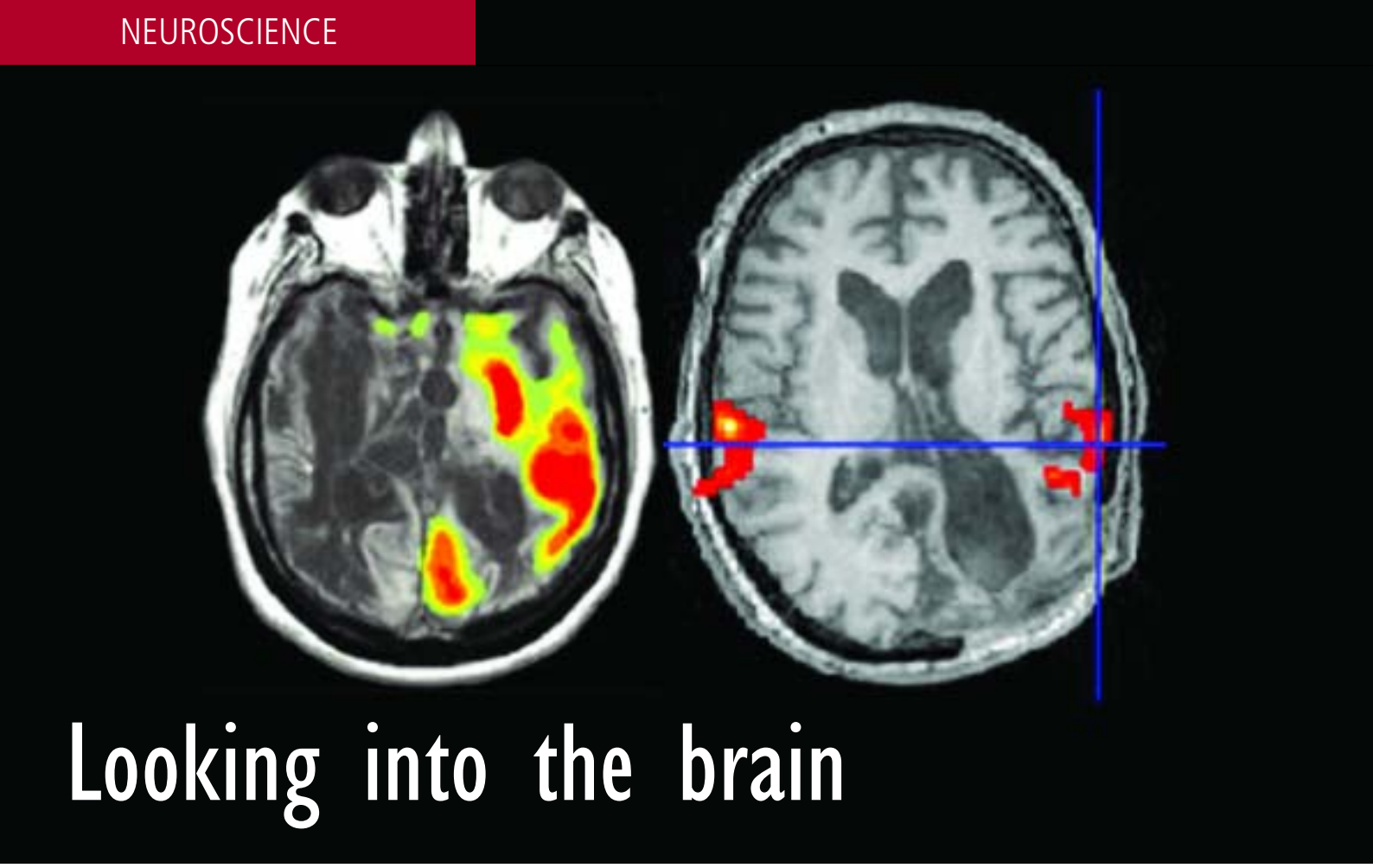
This combined sensory and motor variability limits the precision with which we can perceive and act on the world. Society places a premium on those of us who can reduce the overall variability of our sensory processing and motor outputs – financial rewards accrue to those who can reliably hit a small white ball into a hole several hundred yards away using a long metal stick.

Wolpert's group has shown that not only does society care about reducing variability, but also that the brain dedicates its resources to reducing the uncertainty and variability in sensory and motor processing.

To investigate how the brain reduces uncertainty the group has developed state-of-the-art robotic interfaces and virtual reality systems that allow researchers to control the environment as well as the visual feedback that volunteers experience during skill learning tasks. Using this apparatus, the group has recently shown that when we learn a new task, although we are not aware of it, our brains combine our prior experience with our current sensory input in an optimal fashion.

The precise way in which these two sources of information are combined is given by a formula known as Bayes rule, named after Thomas Bayes, an 18th century English Presbyterian minister. The fundamental idea of Bayes rule is that probabilities can be used to represent the degree of belief in different propositions about ourselves and the world – such as the probability that one is looking at an apple or tennis ball or that one's hand is at different possible locations when hidden under a table-top. Bayes rule specifies the optimal way that these probabilities should be updated as new information is received. Bayesian methods are currently a major component of statistics and Wolpert's group is investigating to what extent they may provide a unifying mechanism by which the brain makes estimates about our own body and the world and chooses optimal actions.

http://learning.eng.cam.ac.uk/wolpert/



Looking into the brain

The Wolfson Brain Imaging Centre is a unique venture that brings together scientists and doctors from Cambridge University and Cambridge's Addenbrookes Hospital to harness the power of state-of-the-art positron emission tomography (PET) and magnetic resonance imaging (MRI) for the development of new treatments for patients with brain disorders.

Professor John Pickard

Neurosurgeon Professor John Pickard is chairman and clinical director of the centre. "Nobody else in the world has got the kind of facilities that we have," he says. "These unique facilities have enabled a number of breakthroughs in research. We now have new insights into what happens in the brain as patients emerge from a coma, as well as which parts of the brain are affected by hydrocephalus ('water on the brain')."

Doctors are now able to predict the risk of a stroke and distinguish between different types of dementia. Researchers have also used the MRI equipment in new ways to detect how malignant brain tumours spread through the brain and hence focus radiotherapy more appropriately. Other research breakthroughs include the identification of areas of the brain involved in appetite and recognition of facial emotion, leading to new concepts of how brain malfunction may lead to eating disorders and autism. And knowledge gained at the WBIC has helped researchers design new equipment such as the patented scanner that combines PET with MRI, tackling the key problem of how to localise and resolve in fine detail the distribution of novel chemicals within the living brain.

The Centre's mission is to advance the understanding and management of the most challenging and critically ill of patients with disorders of the brain, spinal cord and mind from initial illness through rehabilitation to final outcome.

In the last 20 years, death rates for people with acute brain injury have been almost halved because of good medical care. And that does not mean simply keeping people alive – the proportion of severely disabled patients and those in a vegetative state has fallen too. "We are trying to improve the management of patients with acute brain injury and to explore exciting new drugs," says Pickard. He believes strongly that society still does not understand the need for urgency in managing patients with all forms of 'brain attack' and the need for timely rehabilitation. For example, people should act far more quickly on signs of a minor stroke – like short periods when a person is unable to speak – because so much can be done to help. "One of the problems we have to change is the perception of the general public that once you have had a stroke, there is nothing you can do about it. That is not true. If you have a stroke and have treatment, you can avoid ending up in a nursing home for the next 10 or 20 years." he says.

www.wbic.cam.ac.uk/

Addiction treatment – genes can play a part

Imagine a one-off cure for drug addiction or post-traumatic stress disorder (PTSD) instead of today's life-long therapy regimes. Professor Barry Everitt and Dr Jonathan Lee of the MRC-Wellcome Behaviour and Clinical Neuroscience Institute have shown that they can selectively impair memories associated with drug addiction and PTSD by inactivating a specific gene in the brain.

Anxiety disorders, such as phobias and PTSD, and also drug addiction are disorders characterised by the persistent impact on behaviour of memories laid down earlier in the lives of affected individuals.

In the case of drug addiction, addicts crave drugs and suffer relapse not just because of the alluring high of drugs, but also because they are compelled by the powerful, haunting memory associations with the stimuli closely associated with their drug taking (e.g. the paraphernalia of syringes, aluminium foil, specific people) and, indeed, the environment in which their drug taking occurs.

For many years it has been assumed that once memories are formed, they become fixed – 'consolidated' – forever. However, recent research has shown that when memories are reactivated through recall, or simply being exposed to stimuli that elicit memories, as in drug addicts, the memories become malleable and subject to disruption by certain drugs.

Everitt and Lee saw a long-lasting change in behaviour of rats that had had a specific gene in the amygdala – a part of the brain where emotional memories are formed and stored – inactivated. Of course, selective inactivation of genes in the brain is not a viable treatment option and so current research is aimed at identifying the neurochemical mechanisms in the brain that underlie memory reconsolidation and thereby drugs that can be taken systemically to interfere with those mechanisms. The great advantage of this potential new treatment is that it could be given on very few, perhaps even one, occasion, thereby eliminating the need for chronic drug therapy and all the problems that can bring.

http://research.psychol.cam.ac.uk/~bcni/

Amniocentesis: a key to identify autism in the womb?

Cambridge researchers are pioneering a new test for autism in the womb, by measuring the levels of testosterone produced by the foetus, which makes its way into the amniotic fluid. They hope to test if children who later develop autism have unusually high levels of testosterone between 12 and 20 weeks of pregnancy.

The new research is based on a study that the Autism Research Centre lab has been engaged in for the last 10 years. That was when the lab started collecting the samples of amniotic fluid that are taken routinely in about six per cent of pregnancies. Usually these samples are analysed for chromosomal abnormalities that might predict the unborn child to be at risk for conditions such as Down Syndrome. After the cytogenetics lab has tested for such chromosomal abnormalities, the fluid is stored for up to a year before being disposed of. Researchers have taken the novel step of asking the biochemists at Addenbrooke's Hospital to test these samples for the amount of the 'male hormone', testosterone.

Of course, testosterone is not just a male hormone, as both sexes produce it. Male foetuses produce twice as much as females, and it is of interest because animal research suggests it is foetal testosterone (FT) that has an organising effect on brain development. It is well recognised that the average male brain differs from the average female brain, not just in overall size (males having the bigger brain) but in the size of specific structures in the brain. In the average female brain, structures like the corpus callosum (the connective tissue between the two hemispheres) is thicker, whilst in the average male brain, structures like the amgydala (the almond-shaped brain region deep beneath the cortex, sometimes thought of as the emotion centre) is bigger.

Testosterone is produced in males by the testes, and in females by the adrenal glands, and then is taken up in the blood to the brain. It crosses the blood-brain barrier and binds to Androgen Receptors. The regions of the brain that differ between the sexes also differ in the number of Androgen Receptors. The Androgen Receptors, bound with testosterone, affect neural connectivity in different ways.

The significant issue is that even within one sex, there is substantial variation in how much FT is produced. Some girls produce as much as boys in the typical male range, and some boys produce as little as girls in the typical female range. The question the research has been testing is: does your FT level

before you are born predict anything about your later psychological development?

The answer is clear: yes it does. FT levels are *negatively* correlated with the amount of eye-contact the child makes at 12 months, how fast the child is developing language at 18 and 24 months, and social skills at 48 months of age. These results are found not just when boys and girls are combined, but also when just boys are studied. FT levels are also *positively* correlated with 'narrow interests' at 48 months old. The research findings have recently been summarized in a monograph by the team (*Prenatal Testosterone in Mind*, MIT Press, 2005).

These studies have so far only followed children who are developing normally, but show that individual differences in sociability, language development, and narrow interests (even within the general population) are influenced to some extent by prenatal hormones. The lab is going on to test much larger samples (thousands, instead of hundreds) in order to see if children with a formal diagnosis of autism or Asperger's syndrome had higher FT levels in the womb. Larger samples are needed because autism only occurs in about one per cent of children.

The relevance of this study of FT to autism is two-fold. First, it might reveal an important cause of autism, opening the door to further basic biomedical research investigating genetic factors influencing FT. Related to this, it might help explain why autism is far more common among males. Second, a prenatal test could enable intervention to begin at birth, rather than waiting for years by which time valuable opportunities for special education or other kinds of learning may have been missed.

The researchers are clear that they are not undertaking this kind of research in order to lead to termination of the pregnancy, simply because autism exists on a spectrum of severity, and at the milder end of the spectrum the condition is often associated with unusual talents: for example, the narrow interests might be channelled into fields such as mathematics or music, not just social or communication disability.

www.autismresearchcentre.com/arc/default.asp

Professor Simon Baron-Cohen

Building to a crescendo: Renaissance Venice and the sonic cathedral

At risk of disappointing those aficionados who enjoy a good spat, society seems to be in general agreement about the best places to hear classical music.

Just as it is possible to predict Beethoven, Mozart or Bach's appearance in a countdown of the 10 greatest composers, so the likes of Amsterdam's Concertgebouw, Boston's Symphony Hall and Vienna's Musikverein are regular features of similar best-venue critical lists.

But architects and musicians alike are still perplexed as to *what* makes a great concert hall. In Venice, Deborah Howard, a Professor of Architectural History at Cambridge, is leading research into the churches of 16th century Venice which could throw up some answers. Her focus is on how composers took account of buildings' acoustic properties, and how architects of the time sought to meet contemporary musical needs.

It is a project that has crossed the arts-science divide, bringing together about 40 architectural historians, musicologists and acousticians. By the time it is over, the choir of St John's College, Cambridge, and a substantial public audience will also have taken part. Technology is being used to test the acoustic properties not just of buildings that are still standing, but remarkably, some that are not.

The results will have exciting implications for how we understand the relationship between musical performance and architectural space, not just in the buildings of Renaissance Venice but those of other periods as well. By extension, they could come to influence how such venues are designed in the future.

"People are still trying to understand why the classic venues for music are so fantastic because acoustics is a very subjective thing," says Professor Howard. "A lot of acoustics is to do with the way people feel about things. For example, a stage may be lined with wood because the public thinks that you get a better effect and the acoustics will therefore be better. One part of our research will be getting an audience to fill in questionnaires about what they think is going on. We have had an extraordinary range of responses to what people thought the acoustics were like in different places."

In Renaissance Venice, music and architecture seem to have blossomed in harmony. The 16th century witnessed major advances in the sophistication, richness and religious expression of choral polyphony, notably in the rise of *coro spezzato* (split choir) performances. At the same time, some of the most admired churches in the whole of the western canon were being erected, such as Palladio's two masterpieces, San Giorgio Maggiore and il Redentore. Architectural treatises suggest their designers boasted an advanced understanding of acoustics. But no systematic test of the buildings' acoustic properties has been carried out.

The team has looked at

Canaletto, View of the Grand Canal ©The Fitzwilliam Museum, Cambridge

smaller venues as well. In each case the building's architectural history is investigated using archival documents, alongside musicological research into what scores and repertoires were available. Scientific measurements of the acoustics of each building are taken by creating and measuring noises at different frequencies. The tests should be complete in early 2007.

Back in Cambridge, one of the project's most remarkable aspects has been developed using the anechoic (i.e. echo-less) chamber in the University's Faculty of Music, where the choir of St John's College has recorded sacred music from the period. This is now being fed into computer simulations of buildings which no longer exist or have been drastically altered since the Renaissance. For instance, the church of the Incurabili, renowned for its excellent acoustics, was demolished in 1831, but has been given this audio "reconstruction" to test its acoustic properties.

Scientific measurements of the acoustics of each building are taken by creating and measuring noises at different frequencies.

The bilingual proceedings of the project's first conference, held in September last year, have just been published as *Architettura e Musica nella Venezia del Rinascimento*, edited by Deborah Howard and Laura Moretti. This September, the team met in Cambridge to plan more choral experiments for Easter 2007. These will form the climax of the project.

From 8 to 15 April next year, St John's College Choir (pictured right), which specialises in *coro spezzato* performance, will carry out choral tests in the various churches, using a period repertoire. "We want to try and see what works musically because we don't know where in the building the choirs were," Professor Howard explains. "We are not trying to produce an authentic performance. We want to actually figure out what worked and what didn't. If you're doing very elaborate music in very complex harmonies and you have a very long reverberation time it's just a mush; you won't hear anything."

The singers and audiences will be invited to offer their conclusions and any readers of this magazine who happen to be visiting Venice next Easter are welcome to take part. The views they put forward may end up helping decide music's architectural future – and give those argumentative aficionados one thing fewer to quarrel about.

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Artificial paradise? Our future with social robots

In Steven Spielberg's 2001 box office hit, *AI: Artificial Intelligence*, a couple adopt a robot boy, David, as a substitute child while their own son is hospitalised with little hope of recovery. At first the mother, Monica, responds negatively to David's arrival. But with time, she warms to the machine, which is programmed in such a way that when she speaks it turns to her and recites the line, "I love you mommy".

In the film, this blossoming relationship is thrown into turmoil as the real son recovers and forces Monica to choose between him and David, his robotic substitute. And in real life, we may not be so far from encountering the same kind of dilemma, as a Cambridge researcher is discovering.

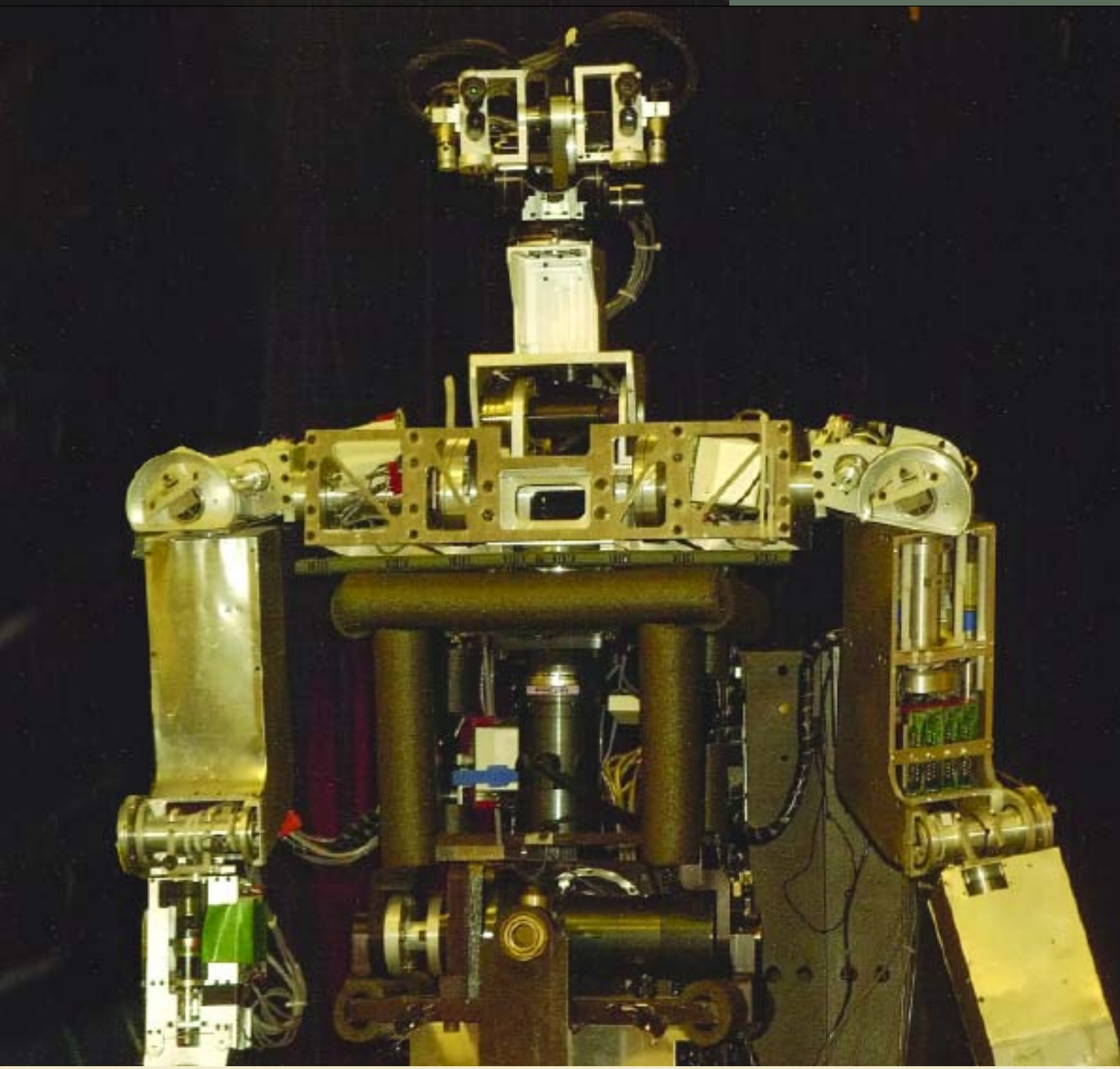
Social anthropologist Kathleen Richardson has carried out fieldwork in the robotics labs at the Massachusetts Institute of Technology. She is interested in some of the same key questions that are raised in *AI*, such as the attachments possible between humans and machines, and what happens to human reactions to those machines when the technological object is given a child-like form.

Interestingly, at MIT, researchers have tried to give robots specifically childish attributes and qualities. This is one approach to what is known as "sociable robotics", where the machines are designed to look and behave in human-like ways. But the attempt to make them childlike in this case is a peculiarity – and a reflection of an attempt to ensure that the robots integrate into the "real" world.

The term "real" here does not just mean the physical environment. It also refers to the robot's ability to interact with humans and for a human to likewise interact with it as they might another person. In other words, attempts are made to ensure the robot also becomes a part of the emotional environment Spielberg's film explored.

At MIT, the robots are designed with human-like faces, which mimic emotional cues and responses. Often the relationship between researcher and robot resembled that between adult and child. Indeed, the researchers talked about a particular robot as if it *was* a child and surrounded the machines with children's toys and brightly coloured objects to test their visual skills and manipulation. By extension, this means that the outside viewer – the ordinary person – was likewise being encouraged to accept the robots as somehow childlike.

What does this achieve? According to roboticists, giving the robot this image challenges cultural preconceptions that they are somehow threatening creatures. If the robots look cute, the viewer relaxes his or her



judgement of the machine. Adults also put in extra effort during interactions if they are thinking of the robot as a child and treating it accordingly.

In some ways this seems to challenge the conventions of current human-machine relations, in which the machine effectively provides a service and little more. But perhaps it has less to do with what robots do now, and more with what roboticists are building towards.

MIT Media Lab roboticist Cynthia Breazeal believes that robots should be seen, and eventually will become, a "companion species", rather than just subjects of use. Gradually, the way in which these robots are programmed will be affected more and more by how we see one another and what we aspire to in human relationship-building.

Perhaps in that sense the themes of *AI: Artificial Intelligence* are not so far removed from the issues in robotics today. As Ray Kurzweil, computer futurologist writes: "Before the next century is over, human beings will no longer be the most intelligent or capable type of entity on the planet… The primary political and philosophical issue of the next century will be the definition of who we are".

CHILDISH?

Does the robot above look like a child? Clearly not, and yet people engaged in the research study have not only given robots names (Cog above, and Mertz left) but surrounded them with children's toys and brightly coloured objects to provide them with visual stimulation.

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Fallacies of Freedom Talk in Africa

Talk of "hard-won freedom" can be a threat to the very freedoms being celebrated. Harri Englund, a University Lecturer in the Department of Social Anthropology, examines the experience of liberal democracy in Malawi over the past 15 years.

Freedom, like development and democracy, is something that no-one in their right mind would wish to call into question. Politicians and human rights activists in the southern African country of Malawi often talk about Malawians' 'hard-won' freedoms. Their reference is no longer to the liberation from the yoke of colonial rule but to the civil and political liberties achieved after the end of Dr Hastings Kamuzu Banda's autocratic rule in the early 1990s. British citizens, concerned about the future of their own hard-won freedoms in the context of a war on terror, may wish to support Malawians' quest for freedom wholeheartedly. Yet unthinking endorsements of 'freedom talk' can seriously curtail the scope of freedom itself.

Freedom is by no means an invention of contemporary neo-liberalism, but the specific form the idea has taken in many parts of the world during the past decade is inseparable from neo-liberal reforms. The post-Cold War public policy environment has been overwhelmingly in favour of reforms that promote market economies and diminished involvement by the state in the lives of individuals.

Malawi provides clear evidence of how these reforms have been driven less by national governments than by international financial institutions, foreign aid agencies and transnational non-governmental organisations. One fallacy of freedom talk is, therefore, its failure to reflect on the current situation, when for the first time in their history, Malawians hold regular competitive multi-party elections while all major macro-economic decisions affecting the country are still made elsewhere.

Further fallacies of freedom talk await those who deploy social anthropological methods to explore how the new situation is experienced by Malawian activists and impoverished citizens. Without sustained fieldwork based on competence in Malawian languages, the freedom talk spoken by eloquent human rights activists could become unduly persuasive. The Malawians certainly have impressive achievements to show to foreign observers and aid donors. Politicians' commitment to liberal democracy appeared erratic during the new president Bakili Muluzi's decade of rule. Human rights organisations, often in collaboration with churches, halted politicians' retrogressive moves and supplied the independent media with critical voices. Yet their

interest in civil and political liberties did little to focus public attention on the causes of impoverishment and exploitation among Malawi's majority.

Activists' narrow view of freedom was apparent in their translation of the concept of human rights. In Chichewa, the national language of Malawi, human rights came to be defined as *maufulu* – freedoms – a concept that became the focus of non-governmental organisations' civic education efforts among the rural and urban poor. The cry 'you can't eat freedoms!' was a common response to this civic education. It arose from chronic food shortages, an overburdened school system and salaries that were below even the pitiful minimum wage. Activists were selective in hearing what the targets of their civic education wished to express: popular claims to entitlements and obligations were precluded by activists' stubborn insistence on human rights as individual freedoms.

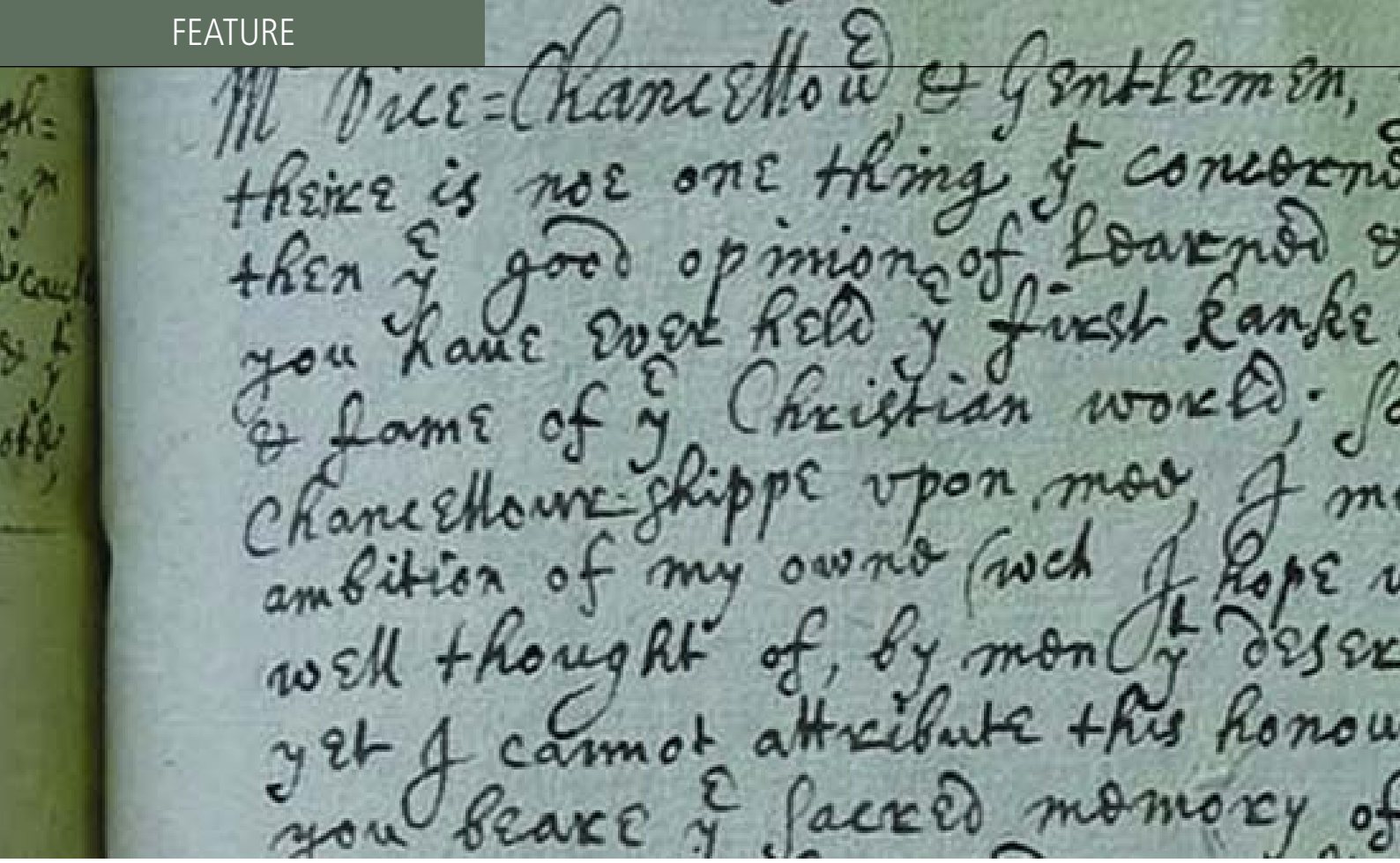
The material trappings of human rights activism were only one, albeit important, aspect of activists' reluctance to engage with the concerns of the poor. For example, the European Union spent millions of Euros to support a civic education project whose district offices ran budgets that exceeded those of many government departments. Decent salaries combined with international connections to make the non-governmental sector look particularly attractive to young graduates. At the same time, the new talk about freedom became an aspect of the entrenched elitism that formal, Western-style education had nourished in Malawi. Time and again, civic educators would attribute popular doubts about freedom to low-levels of education, if not outright ignorance, a condition that made civic education appear indispensable. The ability to talk about freedom was a mark of sophistication and cosmopolitanism, never mind its actual parochialism.

While freedom talk imprisoned the minds of human rights activists, their personal lives could not escape the popular concerns their civic education usually ignored. As resourceful people, activists were firmly placed in the networks of familial obligations among the kinds of people they encountered during their civic education. The salaries of the non-governmental sector supported business ventures among disadvantaged relatives, paid school fees and contributed to wedding and funeral ceremonies in home villages. No-one talked about freedom when these arrangements were negotiated, and yet it was only through such obligations that freedom could have a meaning in the lives of the Malawian poor. Civic education defined freedom as a state of being that could be achieved once and for all. The everyday lives of activists and their rural relations indicated that freedom could only be exercised in situations; it came in moments.

When observed as an aspect of Africans' everyday practices, freedom appears to have far brighter prospects than suggested by Afro-pessimism, the crippling conviction that Africa's ills are irredeemable. The challenge of identifying those prospects is as much intellectual as practical. The universalism of current freedom talk should not obscure the particular interests it serves. Nor should the general import of particular claims, such as those made by the Malawian poor, escape our attention. They compel a fresh recognition of obligations as a source of freedom, a recognition that may carry significance far beyond Africa.

Harri Englund is University Lecturer in the Department of Social Anthropology, University of Cambridge. His latest book *Prisoners of Freedom: Human Rights and the African Poor* has recently been published by the University of California Press.

Civic education in progress



Opening the treasure chest

Cambridge is leading the way in Resource Enhancement projects in the UK, opening up its unique and valuable collections to scholars worldwide, as well as the wider public. There is a huge amount of activity in this area across a number of projects and disciplines, from digitising records of everyday life in medieval Britain to transcribing audio cassettes of oral history from south Asia

Read the "filofaxes" of Early Modern Britain

The Scriptorium project, run by the Faculty of English, aims to provide open access to British commonplace books from the medieval and renaissance periods. The collection will be digitised and transcribed to improve access to the collection.

Commonplace books are a cross between diaries and scrapbooks, either owned by individuals or contributed to by groups or households, providing a rich seam of personal historical information. An aspect of the challenge of digitising the collection is that commonplaces are very difficult to categorise. There is no "typical" example: one book may be a set of household accounts, another may contain recipes, proverbs and tables of weights and measures; another still may be a "poetic miscellany", recording the favourite poems, proverbs and prayers of a group of friends.

This introduces further complexity to the project, as commonplace books can contain entries in various languages and styles of writing so the Scriptorium will also feature an online palaeography course, allowing users of the resource to acquire the skills and knowledge to understand the scripts.

Voices from the past

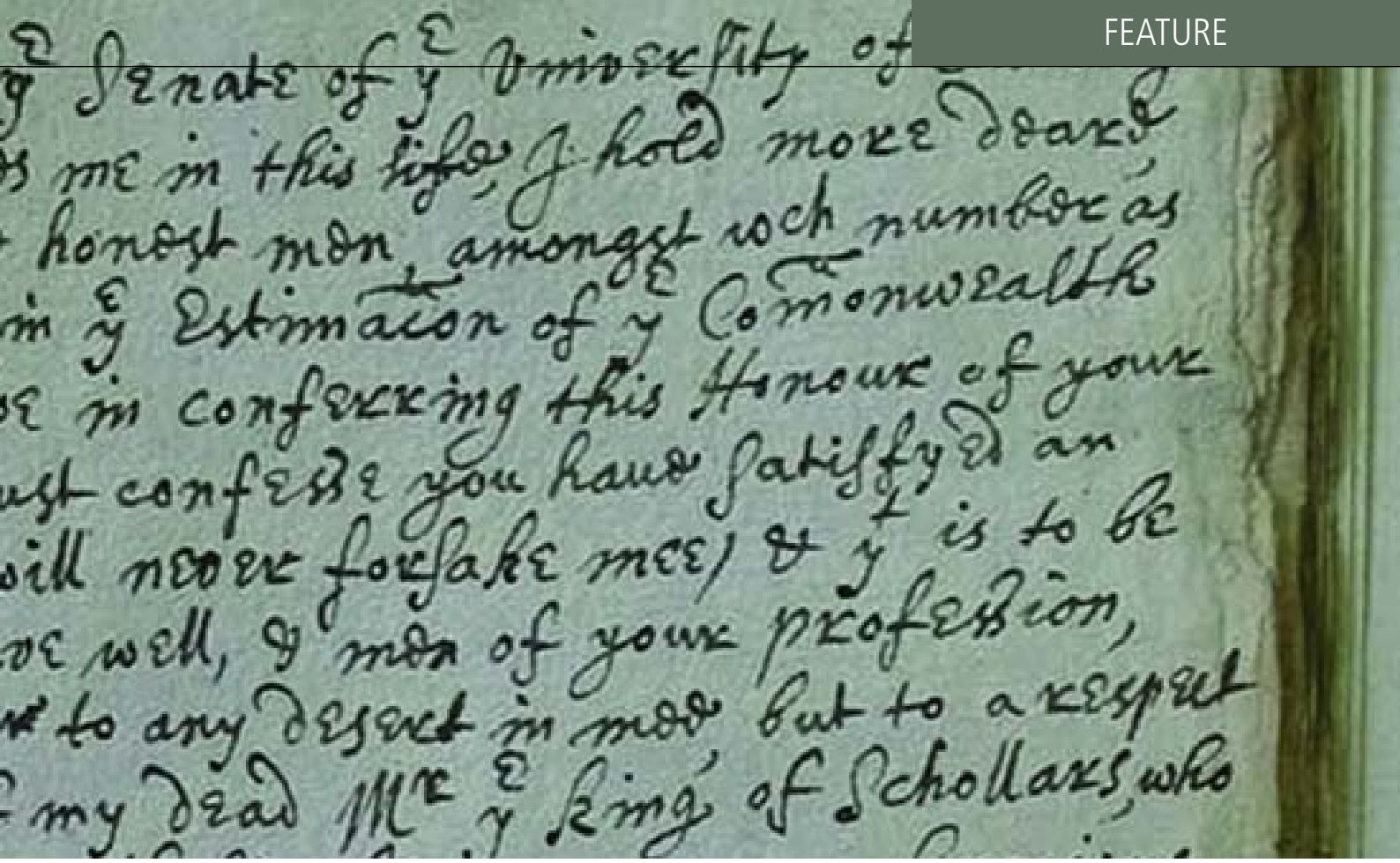
The Centre for South Asian Studies is also engaged in an ambitious project to digitise and publish access to its Oral History Archive.

The value of the archive is without dispute. It takes the form of a collection of around 360 interviews, across 420 hours of playing time, plus transcription running to around 8,000 pages of text. All interviews offer first-hand experience, and because they record the views of individuals, contain little or no bias, with clear benefits to academics.

The media on which the interviews are stored are mainly cassette and reel-to-reel tapes. This means that the archive in its current form is fragile – magnetic tape being more fragile with each use unlike printed paper – and interest in the collection is increasing all the time. So there is a need to preserve the collection for future use, and at the same time broaden and enhance access.

The challenges involved in digitizing the collection have been immense. Often one interviewee's output is recorded across multiple tapes, where blank space was available, which means that before output can even be transcribed, the order of the interview must be established and transferred to digital storage. This is not even to mention the variable sound quality, and the inclusion of a number of previously unknown words and terms.

Work began in March 2006 and from autumn 2006 it will be possible to trial the pilot project comprising ten interviews, chosen at random. The collection will be



Duke of Buckingham's Letter to the University of Cambridge, 1626, Gonville and Caius College

searchable by interviewee and by broad topic, and individual interviews can be searched (via their transcripts) by more detailed keywords. The transcripts can now be read, in the search-result areas, with the corresponding soundtrack running alongside. One of the purposes of the trial is to evaluate how researchers want to use the resource prior to launch of the final version.

Zadokite Fragment "A"; the Covenant of Damascus, part of the ideology of the Dead Sea sect. Cambridge University Library.

Genizah: embodying Jewish survival

The Genizah On-Line Database (GOLD) project is a major undertaking for the Taylor-Schechter Genizah Research Unit and the University Library.

In 1898, 140,000 fragments of documents and texts recovered from the Cairo Genizah (the synagogue archive) were gifted to Cambridge by Dr Solomon Schechter. The items in the collection had taken less than 60 days to amass, but it has taken over a century to preserve, classify and house the greater part of them in a way that makes them easily available for study. Most of the fragments are in manuscript, and many are on vellum, which has contributed to the challenge.

The collection features a wide range of content, from the sacred, to the heretical, to the mundane. It has yielded a vast array of detail, including accounts of social, economic and religious activity; the development of Jewish law; the knowledge of famous scholars, sometimes in their own hand; medieval pronunciations of Hebrew; and rare examples of Jewish scientific, artistic and musical work mainly of the 11th and 12th centuries.

The Taylor-Schechter Genizah Research Unit was established in 1974 amid growing interest in the field of Jewish studies and the history of the medieval Mediterranean world. One of its key priorities has been to restore the collection and to improve access to it. Since it was founded, the Unit has not only catalogued the majority of the fragments, but also created a bibliography of scholarly works which reference the collection.

In many ways the latest phase of work is the most important, and lays the foundation for future possibilities in the field and research relating to the collection. The GOLD project aims to provide remote electronic access to the treasures of the collection and facilitate the production of further printed catalogues. Methods are being developed to enhance the efficiency of digital image production, and to bring dispersed manuscripts together through analysis of the descriptions of the manuscripts already produced by the Genizah Unit and by other co-operating projects.

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Virtually family: an anthropological

The explosion of the broadband internet is allowing anthropologists to carry out research into virtual, as well as real communities. Xiaoxiao Yan, based in the Department of Social Anthropology at Cambridge, has a longstanding interest in the relationship between culture and technology and has been investigating the impact of broadband technology since 2002.

As part of Xiaoxiao Yan's PhD study, she went back to Beijing during 2004-5 and did fieldwork on China's first online community, which at the time had a history of 10 years and 300,000 users. Her findings, which take the form both of a series of papers and a film, have aroused considerable interest within the British broadband industry.

Xiaoxiao is interested in how communities are constructed in a different cultural context. The rise of broadband, still at an early stage in terms of its across-the-board availability, makes it ripe for examining the growth of virtual communities, in this case in China.

Here, Xiaoxiao found that Chinese users access broadband to develop close social relationships as more traditional means of forming bonds in that country are breaking down. Tools such as the instant messenger, bulletin board, forum, blog or online game are becoming increasingly important to many people in this respect.

One manifestation of this is that while bulletin boards and online forums in Europe or the United States are often small and specialised, the Chinese versions are often giant in scale, attracting millions of registered participants to varied topics covering all aspects of life. This, Xiaoxiao argues, suggests they provide users with a "society of familiars" and a ritualised routine which helps form a sense of belonging.

A feeling of such belonging is important to Chinese people. It is also less and less available in modern-day China. The country is undergoing rapid urbanisation, with 10 – 15 million people moving to towns and cities every

knowledge of the broadband internet

year. The old village or clan communities on which social relationships once relied are breaking down. Meanwhile, the introduction of a market economy since 1978 has put an end to the situation in which state-owned work units took charge of people's private and public life, thereby creating a community around one central point of reference and organisation. The one-child policy in China is also breaking down traditionally large families.

In other words, China is changing from a society of *familiars* into a society of *strangers*. As this happens, the broadband internet is increasingly providing an alternative society of familiars in a virtual setting. People feel almost compelled to reclaim a sense of belonging via a low-cost, knowledge-intensive, efficient approach, which the internet offers them.

Xiaoxiao's film, *The Story of SKS – on community construction, trust and entrepreneurship* takes the argument a step further by following a young couple, both active internet users, as they build a second-hand laptop business. By developing trusted relationships with their customers, they are able to fulfil an ambition of entrepreneurship – a dream shared by many young Chinese people today.

British Telecom has been able to use this in particular as an insight into customer relationship-building in the Chinese service industry. From a business perspective, the virtual society of familiars enables people to experience what makes people in China tick without actually being in China. "Understanding how to construct communities and build trust is key to any future service we might provide," Jeff Patmore, head of strategic university Research at BT, says. "The unique insight this research provides allows us to make far better business decisions."

Anthropologists have long been reflecting how anthropological knowledge and ethnographic data can be evaluated and become evidence outside the discipline, not least because often it takes the form of subjective experience rather than "scientific" fact. Xiaoxiao's film provides a perfect example of how such evidence reaches beyond the bounds of academia.

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New technologies in counter terrorism

What are the most effective new technologies for detecting chemical or biological attacks? How can they predict the dispersal of chemical or biological agents? What do these predictions tell us about how the authorities should react to a chemical or biological attack – and the advice they should give the public?

How can passport authorities, airlines, airport authorities and transport operators maintain the highest level of security? What are the latest scientific developments to detect concealed weapons or other hazardous devices beneath clothing? Can we automatically detect and localise human faces in scenes with no prior information about scale, orientation or viewpoint?

A range of new technologies to help combat increasing threats to security will be showcased at a seminar in Cambridge on 5 December 2006, entitled 'Risk, Threat and Detection'. Disciplines represented at the seminar will include Biotechnology, Chemistry, Engineering, Physics and Computer Science, bringing together some of the world's leading scientists to address these highly topical and often controversial issues.

The Computer Lab's Security Group will present their latest research in location and positioning systems, display security, censorship resistant technologies and the analysis of topological attack and defense in complex networks. They will examine how various attack and defense mechanisms scale with network size, the best methods of attacking various types of networks and the best way of defending them. There will also be presentations on the latest research in terahertz radiation, face, iris and fingerprint recognition.

The seminar will offer an unparalleled opportunity to question, probe and debate this highly relevant subject. The event will take place at Cripps Court, Magdelene College, Cambridge and will be followed by the *Horizon* Christmas drinks reception. **For further information please contact Jo Ryan on +44 (0)1223 765404 or email horizon@rsd.cam.ac.uk www.rsd.cam.ac.uk/events/horizon/**

BAA Aviation Photo Library

The intelligent airport: a new challenge in managing information

Cambridge scientists are at the fore-front of developing a new vision for managing information in complex environments, and air travellers of tomorrow will reap the rewards.

Communications needs are becoming more complex, and not just because of the proliferation of fixed equipment such as wireless base stations, surveillance cameras, security detection equipment, display and terminal equipment.

The airports of tomorrow will see more compact portable equipment, for example, location and control equipment on a wide range of transportation equipment. Radio frequency identification (RFID) tags supported by a wireless network can be used to sense, locate and track a wide array of objects including luggage and commercial goods and can provide additional features such as boarding pass auto-tags, access control tags and position information – so if you are browsing in duty free when you should be boarding, the airline will know where to find you!

Mobile biometric sensors will become a key part of the new airport environment providing advanced features such as iris scans, image capture and recognition, finger printing and video analysis. This will improve positive identification of passengers but with less intrusion. A range of fixed and mobile terminals will provide security measures such as chemical detection and analysis, while other terminals will support passenger information and entertainment services in transit.

An intelligent, adaptive, self-organising combined wired and wireless communications system is essential in the airport environment, but the network envisaged will be huge and complex, supporting perhaps 10 million information sources, with an anticipated peak aggregate data rate of the order 100 gigabits per second.

This is beyond the capability of any current network and research is needed to understand the principles upon which an effective system could be constructed. Perhaps more importantly, the level of adaptation that will be required in accommodating the wired and wireless services within a single system (rather than by using multiple separate systems as at present) will constitute a major advance in the development of information systems for such complex environments.

Cambridge scientists Professor Ian White and Professor Richard Penty from the Department of Engineering and Professor Jon Crowcroft from the Computer Laboratory are part of a multidisciplinary team who have been awarded £511,000 from the EPSRC for their project 'The Intelligent Airport: A self-organising, Wired/wireless Converged Machine'. The team also includes colleagues at UCL and Swansea University.

This ambitious and multidisciplinary project is a collaborative programme and has strong industrial involvement and support from Laing O'Rourke who will provide the application context, share design experience, user requirements and architectural constraints, Red-M who will contribute propagation simulations and Ericsson who will contribute expertise in complex communication system design. BAA and Boeing have agreed to become involved in the project, providing expertise from the user perspective. Equipment companies, including Motorola, are involved to ensure that expert advice is received across all areas within the project.

For more information contact
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Making sense of CCTV

CCTV cameras monitor many public spaces throughout the world. However, these cameras are merely sensors, and interpretation of the resulting video streams is necessarily left to human operators, much like X-ray machines at airports.

Unlike airports, the burden on CCTV operators is already overwhelming. Hundreds of simultaneous videos stream mostly redundant data, making both active observation and after-the-fact data mining extremely tedious.

The new challenge of localising and counting the individuals in crowd scenes is addressed by the Artificial Intelligence work of Dr Gabriel Brostow and Professor Roberto Cipolla of the Engineering Department's Machine Intelligence Lab. In contrast to previous methods, their approach handles dense crowds with just partially visible people, which in the past has lead to missed detections or the inability to distinguish people from their neighbours.

Instead of relying on the consistent appearance of a person's face and limbs, the new approach looks for coherent motion. Distinctive image features, such as high-contrast pixels found on clothing or hairlines, are tracked throughout each sequence. The features that move coherently in terms of velocity are automatically considered for clustering.

Moving as part of a crowd, each person that passes through the camera's field of view follows their own trajectory. Those trajectories are often very similar to each other, but the new motion-driven algorithm detects subtle differences, revealing what features belong to which individuals.

Through Cambridge Enterprise, this work is being prepared for limited release as a licensable prototype that can be used with videos of crowds of people, as well as animals and insects.

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http://mi.eng.cam.ac.uk/~gjb47/crowds

Terahertz detection – fewer places to hide

Security checks are now part of modern life, but traditional X-ray screening and metal detectors have shortcomings – ceramic weapons and explosives are immune to metal detectors, for example. So how should government buildings, airports and transport links be protected in the future?

The next generation of detection systems will be multi-modal – a variety of techniques will be used for both imaging and detection. For example a white powder is found on an individual, but identifying it is another matter: it may be a narcotic or remnants of explosive material, or it may simply be talcum powder or sugar.

One of the ways to identify materials is by their absorption of electro-magnetic energy. Different materials absorb different frequencies by molecules vibrating against each other: analysing which frequencies are absorbed enables a range of materials, some currently impossible to detect, to be identified.

Cambridge's Department of Physics has been working with a University-backed company TeraView to develop semiconductors which are sensitive emitters and detectors of terahertz (far infra-red) radiation. This is situated in the electro-magnetic spectrum between infra-red (used in TV controllers) and microwave (used for mobile telephone communications).

For example figure 1 illustrates the image of a shoe when the heel has been removed and then a razor blade, plastic explosive and ceramic blade are inserted. The terahertz image taken when the heel is replaced clearly shows the hidden weapons, similarly figure 2 clearly shows the presence of plastic explosive below several layers of clothing, each of which is visible.

Identification at a distance is particularly important and here the absorption characteristics of a each material can be exploited to good effect. For example, the measured spectrum of Semtex-H plastic explosive at a distance of a metre allows for rapid and reliable identification. Results such as this show that these sophisticated new technologies will make a real impact in threat identification.

For further information contact
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mp10000@cam.ac.uk

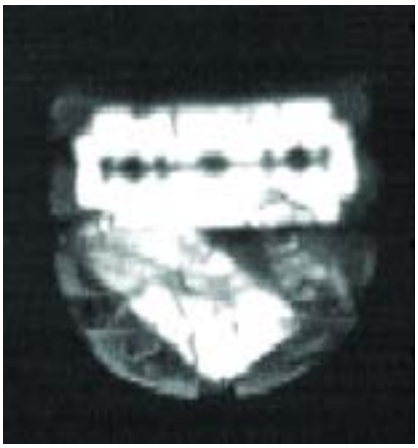

Figure 1

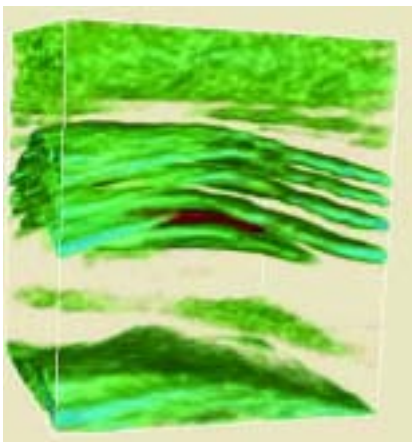

Figure 2

Joining forces against chemical and biological attack

An innovative working group of scientists – half of whom were world-class experts in the field and half creative scientists new to the area – have made a major contribution to the detection and decontamination of chemical and biological weapons.

As well as achieving fresh thinking in the area, the country now has a wider base of scientists investigating this crucial area of national security and the findings of the group will be discussed at the Horizon seminar in December (see page 28).

The Royal Society Working Group on Detection and Decontamination of Chemical and Biological Weapons was chaired by Professor Herbert Huppert, and reported in 2004.

The major recommendation was the need to establish a new centre to co-ordinate and direct the work of improving the UK's resistance to any civilian chemical or biological incident. This has been taken up recently with the inauguration of a centre at the Defence Science and Technology Laboratory at Porton Down in Wiltshire. Other recommendations included the importance of realistic exercises, the need to develop new and existing science, engineering and technology to develop robust, generic detectors of chemical and biological agents and the need to undertake experimental work to determine how best to decontaminate people, buildings, vehicles and the wider environment.

Since the report was published, the Chemical, Biological, Radiological and Nuclear (CBRN) science and technology programme at the Home Office has continued the work. One of the important aspects is that much of the developed knowledge could be relevant not just to a terrorist attack but also to a major accident.

The changes in Home Office procedure due to the report are said to have made the response to 7/7 much more efficient.

For further information contact
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Partnerships make progress

Relationships between Cambridge and its research collaborators are being placed on a firmer footing with the launch of the Research Partner Programme (RPP).

The aim of the RPP is to complement the existing links between academics and sponsors to make the research life cycle as effective as possible. The structure at Cambridge can make it hard for external organisations to navigate, with the loss of potentially valuable links – the programme provides a simple framework for improving information flow and enables partners and the University to get the best from a relationship. We also hope to offer increased opportunities for interactions, funding leverage and engagement between partners to further the success of research projects.

The programme will include free tickets to the Horizon seminar series (see below), a named contact proactively to assist interactions, tailored events for organisations, invitations to Partners events and innovation alerts.

Contact Jo Ryan at Jo.Ryan@rsd.cam.ac.uk for more details.

Scanning the Horizon

A chance to hear about the latest research, its applications and its implications for society, Cambridge's Horizon seminar series is proving a popular way of gaining a real insight.

Cambridge's Horizon seminars provide participants with a first look at new developments in the most important and exciting areas of science and technology. The events bring together experts from academia and industry and provide an insight into the cutting edge of interdisciplinary research.

Horizon seminars enable delegates to broaden their knowledge by listening to the experiences of a varied group of inspiring speakers including key business leaders and prominent Cambridge academics. The speakers create a dynamic forum which provides opportunities for information exchange and meaningful networking among the delegates. Participating in Horizon seminars enables companies who understand the need to anticipate the latest trends and innovations in science and technology to sustain their business advantage and stay ahead of the competition.

The next one-day seminar, *Neuroscience and Society*, will be held on Thursday, 12 October 2006. World leading academic and industry scientists and opinion leaders will detail the latest areas of research and the future trends. In common with other conferences in the Horizon series, the seminar will be followed by dinner in the elegant surroundings of New Hall. Much of the research outlined in this edition of Research Horizons will be explored in greater depth at the seminar.

Future seminars include *Risk, Threat and Detection* on Tuesday, 5 December, looking at security technology and security policy and providing an insight into how a secure future can be achieved for all.

For more information including details of future events and how to book places online visit www.rsd.cam.ac.uk/events/horizon/fourthseries/

Guide to starting a technology company launched

A comprehensive guide for anyone wanting to start a technology company has been launched by Cambridge Enterprise – and it's proving popular outside the University too.

Starting a Technology Company provides an introduction to key topics and valuable insights in starting a science-based business. The guide encompasses Cambridge Enterprise's collective skills of starting numerous businesses with University researchers and reflects the expertise of external contributors who have shared their business acumen and personal experience. Key points in the text are developed and highlighted by accompanying case studies and commentaries from experts.

The guide is available for free as a PDF on Cambridge Enterprise's website: www.enterprise.cam.ac.uk.

New leadership at Cambridge Enterprise

Teri F. Willey, an expert in commercialising early stage technologies based on university research, has joined the University as the new Director of Cambridge Enterprise. Working with University staff and students, Cambridge Enterprise licenses technology and incubates new technology-based companies.

United States-born Ms Willey comes to Cambridge after spending five years as managing partner of ARCH Development Partners, Chicago, an early stage venture fund. Prior to this, she was Vice President for ARCH Development Corporation, a wholly owned subsidiary of the University of Chicago which handles licensing and new company development.

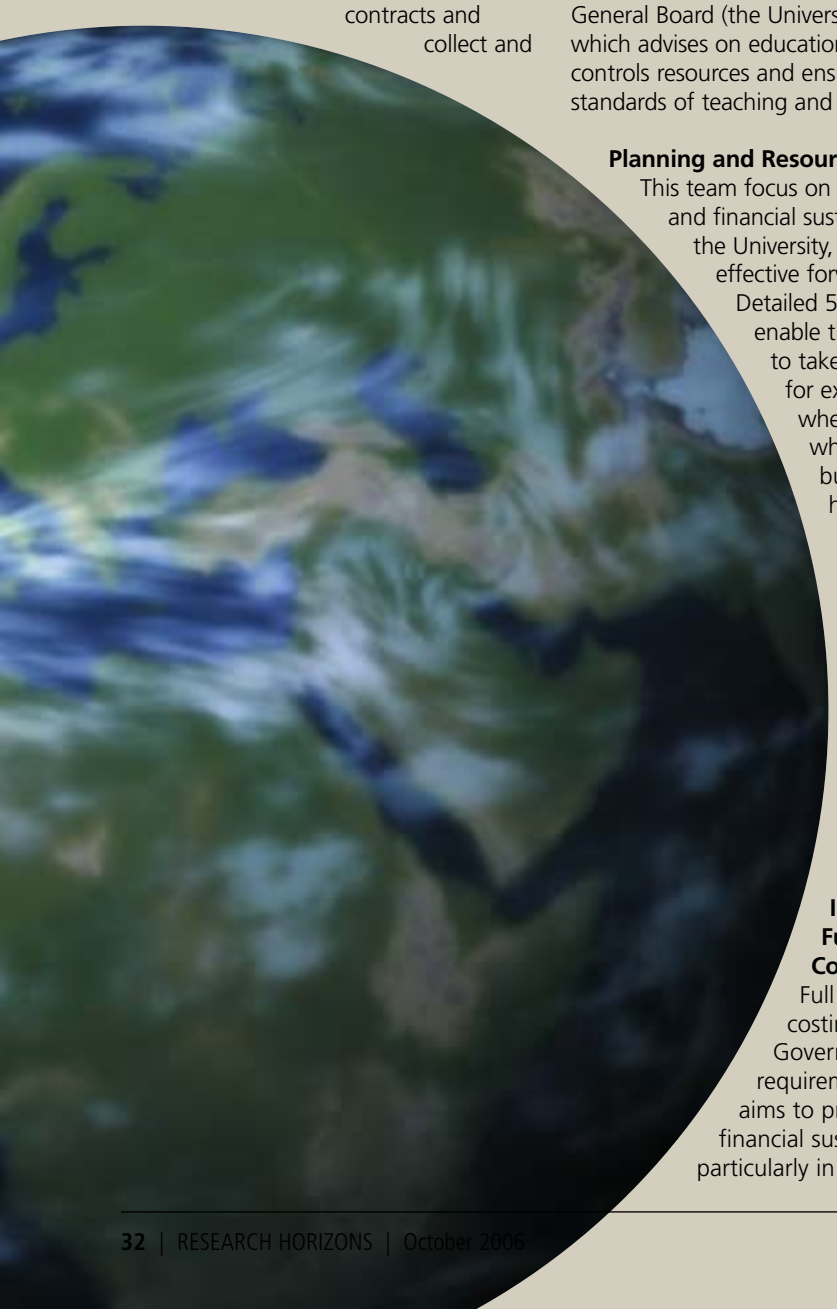
Cambridge Enterprise is one of the United Kingdom's leading knowledge transfer offices, licensing patents and other intellectual property to existing companies, both large and small as well as to spinouts formed to exploit University technology.

In 2005, 40 licences and options were granted (with income from licensing exceeding £2.7 million). Additionally, Cambridge Enterprise assessed 127 invention disclosures and filed 41 new UK patent applications. Three new spinouts have also been created – Camfridge, Enecsys and Enval – with many more start-ups receiving advice and support. Demand for academics' technical advice added a further £1.5 million of consulting revenue.

World-class support for world-class research

Research is one of the fundamental missions of the University, and at Cambridge there are many people who get involved in making the process of finding and administering research funding as effective as possible.

The University of Cambridge is the recipient of the largest amount of academic research income in the UK – some £270 million – and this is granted through both an annual amount flowing from the Government's Research Assessment Exercise (RAE) and from individual grants made to our academics. Research Services Division is the main administrative office in the University tasked with helping academics to find funds, submit bids, negotiate contracts and collect and account for research monies. But across the University, there are many more groups of academics and administrators who assist the process.



Co-ordinating the RAE

Co-ordinating the University's response to the Research Assessment Exercise is critical work, since funding based on the submission accounts for some £100 million of Cambridge's income. The University's Academic Division is home to a team which pulls together the Cambridge response to the RAE – the submission for the 2008 exercise will be made on 31 October 2007, and the team began work on processes for submission about a year ago.

The team answer policy questions on the process, consult with the relevant people and co-ordinate the University response. The Research Policy Committee and the Pro-Vice-Chancellor for Research, Professor Ian Leslie, oversee the work which is then ratified by the General Board (the University committee which advises on educational policy, controls resources and ensures high standards of teaching and research).

Planning and Resource Allocation

This team focus on the budgeting and financial sustainability of the University, enabling effective forward planning. Detailed 5 year budgets enable the University to take key decisions, for example, whether and when new buildings to house researchers can go ahead. The Scientific Research Infrastructure Fund (SRIF) is administered by this team, as is the fEC project (see below).

Implementing Full Economic Costing (fEC)

Full economic costing is a Government requirement which aims to promote financial sustainability, particularly in respect of research infrastructure, but also to distinguish between teaching, research and other costs and public and non-public funding.

Academic time, space costs, facilities costs and indirect costs all need to be captured much more accurately; in the past, Cambridge had used one overhead figure which was an approximation of the total costs. The introduction of fEC means that each project is costed more accurately and this represents a fundamental change in the funding methodology for research.

The Full Economic Costing team, again part of the University's Academic Division implements the University's approach through robust costing and pricing methodologies applied to research projects across the University; the methods will also be developed further to cover other University activities.

Research Policy Committee and the Pro-Vice-Chancellor for Research

The Research Policy Committee considers all key matters of research policy and funding. Chaired by the Pro-Vice-Chancellor for Research, Professor Ian Leslie, the Committee considers agenda items ranging from the University IP policy to information about key sponsors.

Individual Departments, Schools, and academics

Beyond the central administration of the University, staff in every Department and School have key roles to play in the administration of research – some departments have an academic Head of Research, others have senior department administrators who play important roles in the process of bid submission and research funding accounting.

Cambridge Enterprise

Within Cambridge Enterprise, CUTS (Cambridge University Technical Services) Ltd exists to assist academics in their consulting activities by providing professional indemnity and liability cover.

Publicising Research

The Office of Communications has two Research Communication Officers – Genevieve Maul and Tom Kirk – who help to publicise research undertaken at the University.

An enterprising future for Cambridge

Teri F. Willey

Being new to the University and the country, I've been working part time in Cambridge since March to get acclimated to my new environment – and try and better understand what exactly I've gotten myself into. One of my first priorities has been to meet administrators, faculty, students, investors and companies in order to ask their advice, and so far I've only scratched the surface. In the course of this, I've been asked a lot of questions. The most common are "what" and "why".

What is Cambridge Enterprise? Cambridge Enterprise co-ordinates a group of on-going activities to commercialise technology at the University, now operating under one roof. There are three main services offered on behalf of the University that make up technology transfer at Cambridge Enterprise:

1. **Consultancy** – a service offered to faculty to assist with their consulting agreements with industry.
2. **IPR and Licensing** – a service offered to faculty, and where relevant, students, to manage intellectual property rights (IPR), find companies to commercialise IPR and conduct and manage licensing transactions to encourage commercialisation and capture a fair return for the University, departments and faculty.
3. **New Ventures** – a service offered to faculty and student ventures that provides advice, formation services, incubation services, seed funding and an introduction to resources within and outside the University.

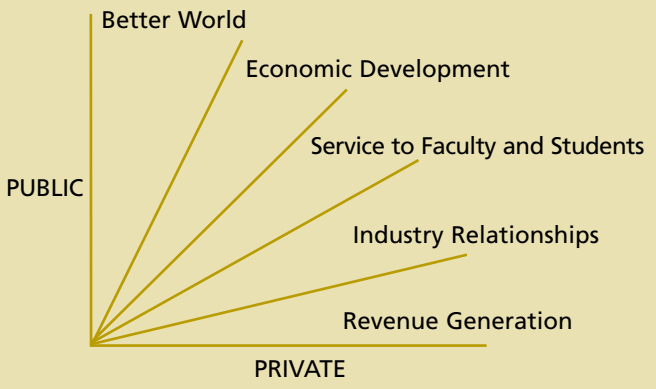
Why are these business efforts at Cambridge Enterprise relevant to the University? A key part of our mission is to help University of Cambridge inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful for the benefit of society, the UK economy, the inventors and the University. This mission is further defined in other documents that call for Cambridge Enterprise to:

i) aid the transfer of knowledge from the University via commercialisation;
ii) aid staff and students in making their ideas more commercially successful; and
iii) produce a financial return for inventors, departments and the University.

This often leads to the question that is the most difficult to answer and maybe the most important: what is the primary mission of Cambridge Enterprise (and how do we decide which cases and projects receive resources)?

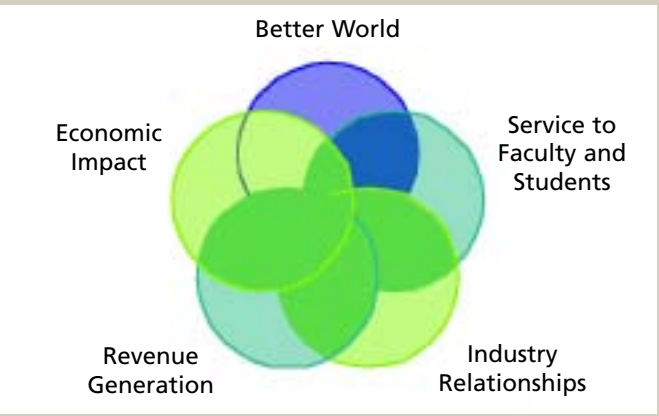
At Cambridge Enterprise, we are subject to a dilemma all university technology transfer programmes face. Though traditional management orthodoxy would suggest having a single purpose, a central paradox of technology transfer is that it serves at least five purposes that are difficult if not impossible to unbundle:

1. Disseminating particular kinds of technology for public benefit by creating incentives to invest in the development of early stage discoveries
2. Catalysing economic development through attracting investment and creating jobs, resources and wealth
3. Provide incentives for faculty (and students) to be involved in the translational process as well as the recruiting and retention process
4. Creating close ties with industry to encourage its support for licensing, research funding and so forth
5. Generating income to distribute to inventors and the academy and to support further technology transfer.

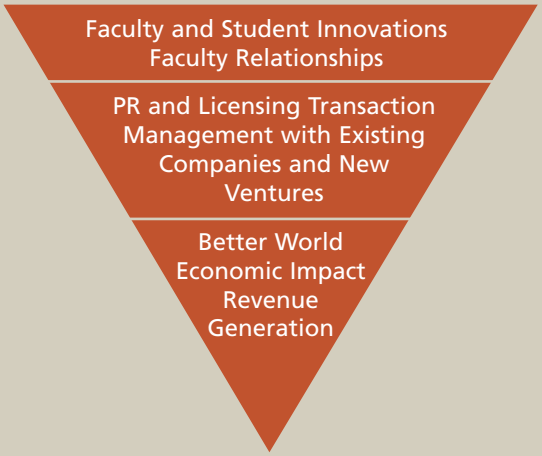


Attribution for the above diagram: Louis Bememan who shared it in discussion at a recent AUTM and other professional meetings.

Ideally, the cases we manage at Cambridge Enterprise should meet all the above criteria, and there are many cases which may do so. Nevertheless, when there is mission conflict, which stakeholder wins? Which of the above criteria receives the most weight? We can strive to weight them equally and make decisions supportive of as many of these five criteria as is reasonable.



But when come down to it, we're here as a service to Cambridge academics. Without faculty and student innovations, we don't have the raw materials to work with to address the other criteria.

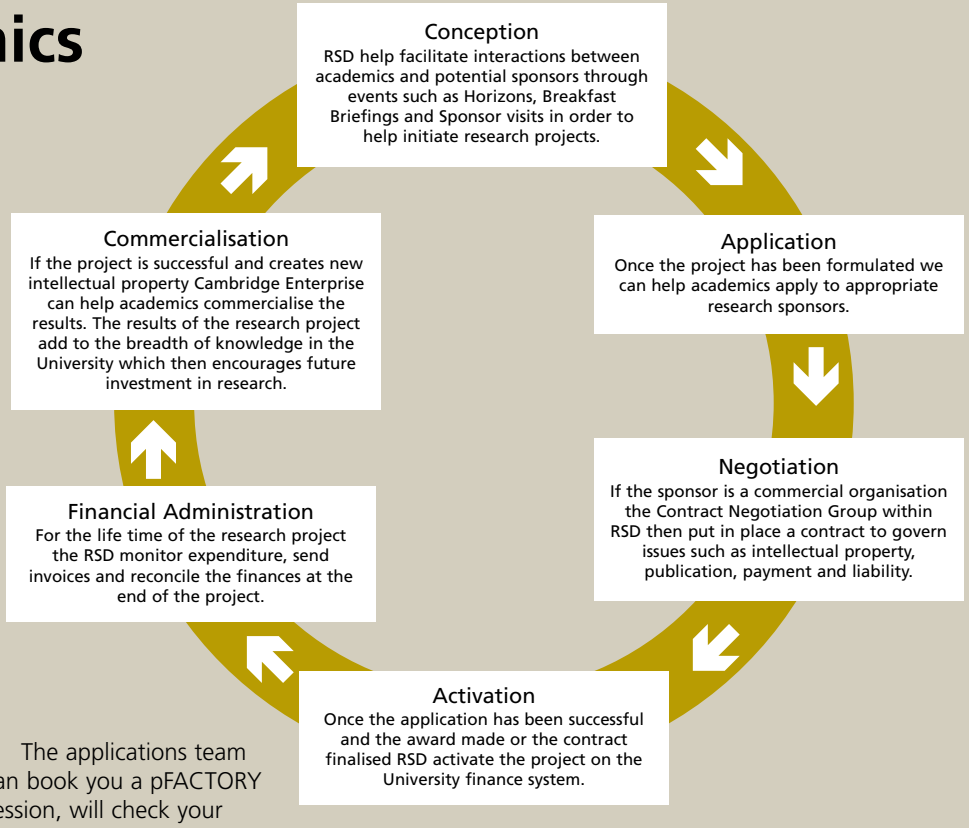


Cambridge Enterprise strives to be a trusted business resource for University faculty and students as it pertains to bringing IPR forward through commercial channels.

For further information visit:
www.enterprise.cam.ac.uk/

Helping academics progress their research

Cambridge's Research Services Division aims to help academics and research sponsors work effectively together, at all stages of the research lifecycle. Whether you are an academic or a potential sponsor, do contact us – we'll do our best to help with any questions and to progress your research project.



The diagram above outlines some steps that we might help you with in your research project – here's an explanation of each and some examples of how we can help:

Are you a researcher with an idea for a project that needs funding? Or a sponsor wanting to work with the best academics in the world?
RSD can help you identify sources of funding, from Research Councils to charities and industry.

Boeing were interested in working with the University and the Partnership team in RSD helped key academics and the company find areas of long-term strategic research for collaboration and funding. Academics in the areas of information security and processing, intelligent systems and automated reasoning met with their Boeing counterparts to propose areas of work and three projects were initiated. The relationship continues to develop and strengthen with other areas of work added to the benefit of both parties.

Are you ready to apply for funding to a research council or foundation?
If you are new to drafting bids or would like some help on a complex project, RSD can help you. We will help you to draft your bid and to work through the analysis of the full economic costs of your project with you in a tailored one to one session.

The Partnership Group helped academics at the Computer Lab and the Department of Engineering to draft and submit a bid to EPSRC for an integrated transport monitoring project. This involved finding industrial partners who would support the bid and work as a consortium. The bid was successful and the project is now live.

The applications team can book you a pFACTORY session, will check your application and submit it for you. They can also offer assistance with determining staff costs and with Full Economic Costing of research proposals, as well as specific advice for the requirements of your sponsor.

Staff in the Department of Modern and Medieval Languages, who were new to pFACT, enjoyed a training session looking at the whole submission process. Following this, several staff have visited RSD to go through a "test" application in more detail and are now ready to prepare actual proposals for the forthcoming funding round, with RSD's assistance.

Do you need help to negotiate or finalise a research contract?
If you are working with a sponsor who has not agreed standard terms with the University already, you'll need help negotiating a contract. RSD will negotiate and sign a contract for you on behalf of the University. The Contract Negotiation Group aim to achieve the best balance between protecting the rights of the academic and those of the University and meeting the needs of each sponsor.

The Centre for Advanced Photonics and Electronics (CAPE) explores areas of convergence in photonic and electronic technologies, giving priority to projects that can be exploited by collaboration with industry. The initial industry partners are Alps Electric Company Limited, Marconi Communications Limited, Dow Corning Limited, and Advance Nanotech Inc. The Contract Negotiation Group negotiated the contracts for each project that the industry partners fund.

Have you reached the stage of having your funding awarded?
RSD will activate the grant in the University Finance System and administer it as required by the sponsor.

SCOUT-03 is a major EU-funded project to provide best scientific knowledge for international assessments on ozone depletion and climate change for the Montreal and Kyoto Protocols. The Department of Chemistry, the Met Office, and other groups across the world including Imperial College London, the University of California and the Max Planck Institute collaborate on this project. The Research Finance Group has dedicated administrators for EU grants who activate the grant in the Cambridge University Finance System and deal with any financial queries from the Cambridge collaborators or the EU sponsor.

Is the research ready and able to be commercialised?
Cambridge Enterprise can advise you about how to set up an enterprise and find commercial funding.

Once the grant has ended RSD will close the grant and direct you to the start of the research lifecycle if you seek continued or new funding.

Please contact us for any further information: www.rsd.cam.ac.uk/ or contact Jo Ryan at Jo.Ryan@rsd.cam.ac.uk or by telephone on (+44) (0)1223 765404).

Your way into Cambridge

Research Services Division helps academics to identify, secure and manage research funding from external organizations. 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.

RSD Contact details

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Debbie West-Lewis fEC Trainer
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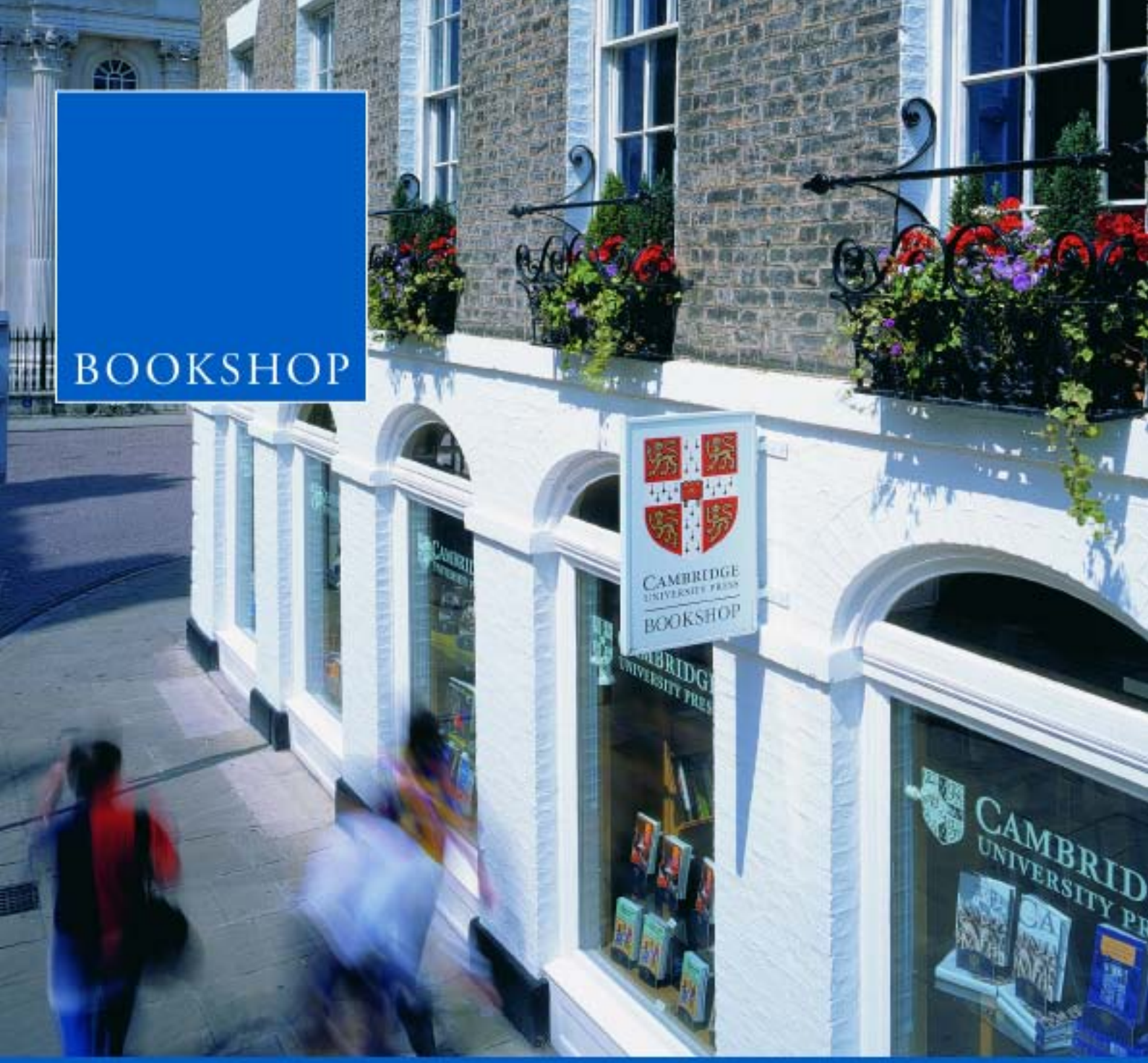

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