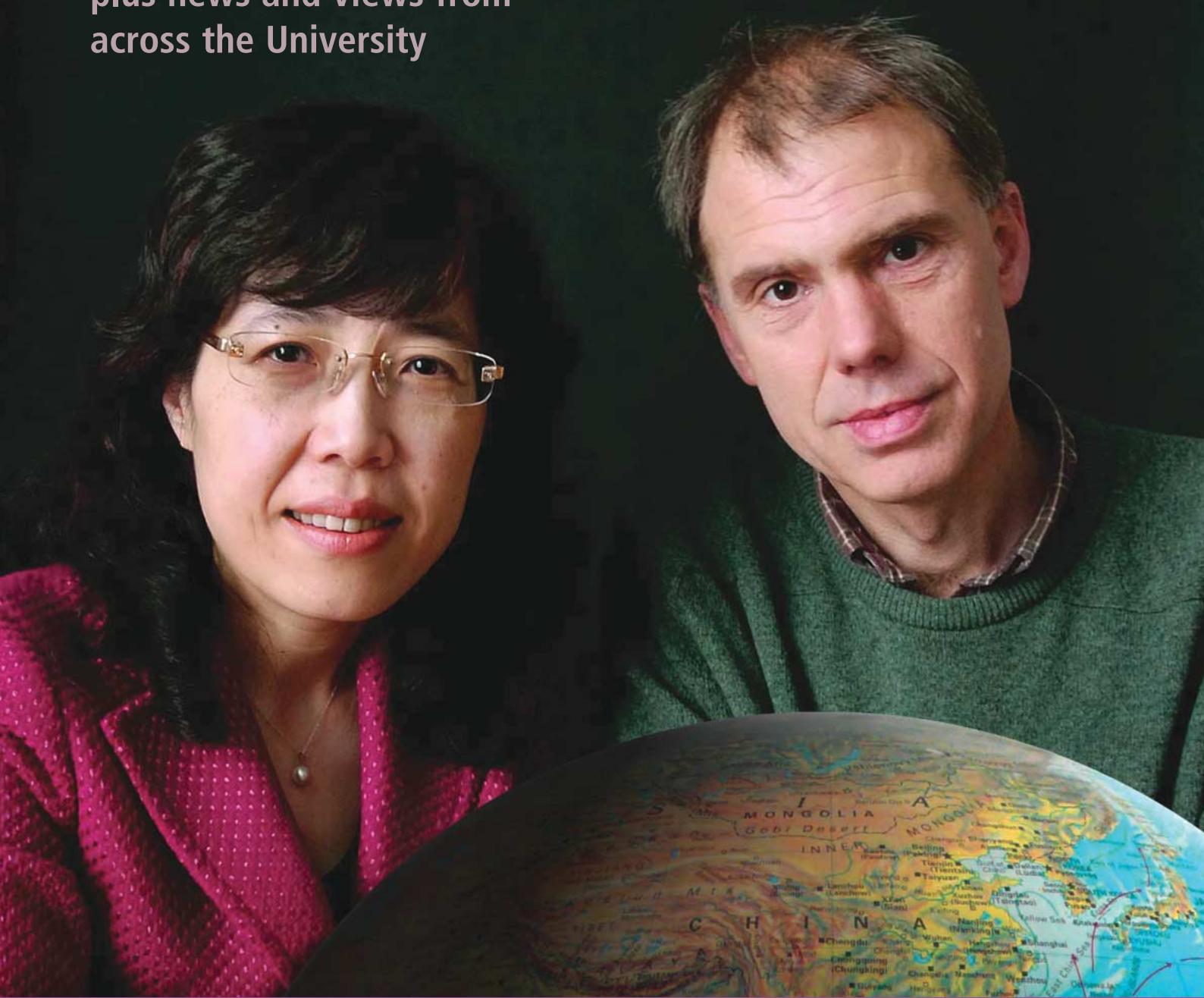


RESEARCH HORIZONS

In this issue

SPOTLIGHT ON CHINA

plus news and views from
across the University



University of Cambridge research magazine
www.rsd.cam.ac.uk
Issue 6 | Summer 2008



UNIVERSITY OF
CAMBRIDGE
800 YEARS
1209 ~ 2009



Foreword

Welcome to the summer issue of *Research Horizons*, focusing on the rich variety of China-related research across the University of Cambridge.

Two academics who share a common interest in China's business interactions with the rest of the world are shown on our front cover. Professor Hans van de Ven, Chair of the Faculty of Asian and Middle Eastern Studies, sheds light on an early period of globalisation in China's modern history. And Dr Jin Zhang from the University's Judge Business School reflects on the remarkable recent development of China's strategic industries.

We also explore China's contributions over past millennia to art and culture, science and technology: from the stories behind the beautiful and intricate jade carvings at The Fitzwilliam Museum, to the fascinating work of Imperial astronomers endeavouring to make quantitative sense of the cosmos. Juxtaposing this heritage with modern-day needs, we hear how state-of-the-art pharmacology is re-evaluating the ancient formulations of traditional Chinese medicine to benefit the drugs of tomorrow. And have you ever considered the cultural identity and politics of noodles? Read on!

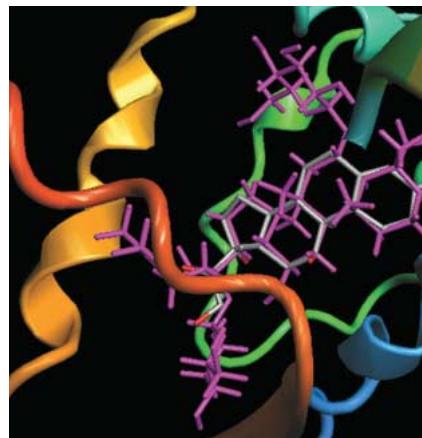
Continuing our aim to highlight initiatives that connect disciplines and harness expertise across the University, we hear about two programmes doing just this: one to enable leaps forward in sensor research and the other to meet the challenges of drug discovery.

We hope that you find much to inform and entertain you in this issue – from the memoirs of a Tibetan princess to the changing face of Eurasian cities, the joy of cinema to the uncertainty of risk, the in-built clocks of plants to sustainable cities of the future. Many thanks go to our contributors for providing these fascinating insights into their research.

Louise Walsh

Dr Louise Walsh
Editor

Research.Horizons@rsd.cam.ac.uk



PROFESSOR RICKY WONG, HONG KONG BAPTIST UNIVERSITY



BRUCE HUETT (PHOTO EDITING: ROY BARLOW)

Unlocking Nature's biochemical secrets

When a woman becomes a religious dynasty

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Cover photograph of Dr Jin Zhang and Professor Hans van de Ven (Photographer: Keith Heppell).

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A new vision for Chemical Engineering and Biotechnology

The recently announced merger of the Department of Chemical Engineering and the Institute of Biotechnology heralds a new dimension for research and teaching opportunities in Cambridge.

Growing out of increasingly overlapping research interests and fruitful collaborations between the two departments, a new Department of Chemical Engineering and Biotechnology comes into effect on 1 August 2008.

'By capitalising on the synergy between the departments,' said Professor Lynn Gladden, Head of the Department of Chemical Engineering, who will lead the new Department, 'Cambridge will be able to respond quickly to emerging research areas that lie at the interface between the disciplines and, crucially, can do so without reducing activities in the traditional areas of chemical engineering or biotechnology.'

'The development is particularly timely in view of pressing global challenges such as how healthcare, food, energy and transport can service a burgeoning population with dwindling resources,' said Professor Chris Lowe, Director of the Institute of Biotechnology. 'By cementing partnerships that unite bioscience, biotechnology and chemical engineering, Cambridge will be well

placed to contribute to sustainable solutions of the future.'

As the Department of Chemical Engineering looks forward to sharing skills with, and learning from, the Institute of Biotechnology, Professor Gladden commented on the recent awarding of The Queen's Anniversary Prize to the Institute of Biotechnology (see page 7): 'We are thrilled that the work of the Institute has been publicly recognised at the highest level in this way and look forward to working ever more closely together.'

Not only will the merger provide new opportunities in research and teaching, but it is hoped that it will open up avenues for commercial translation and the formation of spin-off companies. 'This new initiative allows two already successful departments to move ahead and build a new form of internationally



Holographic concave mirror,
courtesy of Professor Chris Lowe

leading academic endeavour,' said Professor Ian White, Chair of the School of Technology.

**For more information, please contact
Elisabeth Klaar (ek329@cam.ac.uk).**

Digital Cambridge takes off

Are you keen to make your research more widely visible or store and preserve your digital material?

DSpace@Cambridge is ready to take your digital output. Jointly managed by Cambridge University Library and the University Computing Service, the DSpace digital repository has been created to store, disseminate and preserve digital content created by the University of Cambridge academic community. Once deposited, most items are freely accessible to all, both within and beyond the University.

Since DSpace@Cambridge became a strategic service to the University nearly two years ago, a full service team has been recruited and a total of 555 GB of digital data has now been stored. The repository includes everything from scholarly articles to rock art images, medieval and modern manuscripts to lecture series, large datasets and collections.

'As digital material of all types becomes increasingly important for

research,' said Heather Lane, Librarian and Acting Keeper of Collections at the Scott Polar Research Institute, 'we rely on DSpace@Cambridge to provide facilities and support to make our digital holdings accessible to the widest possible audience.' Professor Hugh Mellor, Emeritus Professor of Philosophy in the Faculty of Philosophy, added: 'This excellent facility meets the University's growing need to preserve electronically and make accessible material of permanent importance that would otherwise disappear.'

Use of the service for data preservation and dissemination is free of charge to the employees and students of the University of Cambridge. For more information, please visit www.dspace.cam.ac.uk or contact Elin Stangeland (es444@cam.ac.uk).



Image from the Royal Commonwealth Society Photograph Project stored on DSpace@Cambridge (Ski jump, Alfred Hugh Fisher, 1867–1945)

International award for evolution expert

Professor Jennifer Clack's research into one of the major events in the evolutionary history of life on Earth has been honoured by the National Academy of Sciences.

Over two decades ago, Professor Jennifer Clack and colleagues made a discovery in Greenland that was to overturn ideas of our evolutionary history: a 370 million-year-old tetrapod (an animal with four legs, plus fingers and toes) whose skeleton held the clues to 'terrestriality'. This missing link and the research it generated caused a re-evaluation of when, where, how, and in what order changes occurred during the evolutionary transition from water to land. It is these important contributions to science that have recently been recognised through the awarding of the Daniel Giraud Elliot Medal to Professor Clack by the National Academy of Sciences.

'The transition from water- to land-dwelling creatures in the Late Devonian



PROFESSOR JENNIFER CLACK

Skull of one of the earliest known animals, *Acanthostega gunnari*, which had four eight-toed legs and a bony tail-fin like a fish; found in Greenland, 1987

period is one of the major evolutionary events since it triggered the radiation of all subsequent vertebrate life on land,' explained Professor Clack, Curator of Vertebrate Palaeontology at the University's Department of Zoology. Professor Clack's discoveries, including the earliest foot adapted for walking, initiated a revolution in perceptions of this key transition.

'Limbs appear to have first evolved in water and we now know that the first four-limbed creatures possessed multiple fingers and toes rather than the archetypal five,' said Professor Clack. 'We believe that these evolved to help propel them through weed-choked swamps.' Her climate studies suggest that the transition to land came at a time of low oxygen in the atmosphere, and even

lower in the water, when being able to breathe air became an advantage.

As a result of these detailed analyses, curators are now able to recognise similar fossils in museum collections the world over. The result is a worldwide re-evaluation of the fossil record and a resurgence of interest in the field.

Almost 150 years ago, when Charles Darwin published his theories on the origin of species, the fossil record was frustratingly incomplete, with few examples of transitional stages in evolution. Professor Clack's research is helping to complete the story.

For more information, please contact Professor Jennifer Clack (j.a.clack@zoo.cam.ac.uk).

Morph: reshaping phones of the future

A joint nanotechnology partnership between the University of Cambridge and Nokia has unveiled its concept for the future of mobile phones.

Flexible, stretchable, foldable, self-cleaning and solar-chargeable: this is the new Morph design concept for the mobile devices of tomorrow that was launched in February at The Museum of Modern Art in New York City. Based on the latest nanotechnology and sensor research, the

Morph design showcases the revolutionary leaps being explored by Nokia Research Center (NRC) in collaboration with Cambridge Nanoscience Centre, part of the Department of Engineering.

Nanoscale technologies lend themselves to the manufacture of incredibly strong yet flexible materials with such a degree of elasticity that devices can literally change shape to adapt to the task at hand. Nanostructured surfaces repel water and dirt, and in-built nanosensors have the potential to allow users to examine the environment around them in completely new ways. 'All of these innovative capabilities mean a world of radically different

devices for communicating and interacting with each other in unprecedented ways,' said Dr Tapani Ryhänen, Head of the NRC Cambridge UK Laboratory. 'The research we are carrying out is fundamental to this as we seek a safe and controlled way to develop and use new materials.'

A long-term programme of joint research projects between Cambridge Nanoscience Centre and Nokia began following the announcement of their partnership in March 2007. 'Developing the Morph concept with Nokia has provided us with a focus that is artistically inspirational but, more importantly, sets the technology agenda for our joint nanoscience research that will stimulate our future work together,' said Professor Mark Welland, Head of the Department of Engineering's Nanoscience Group. 'We hope that this combination of art and science will showcase the potential of nanoscience to a wider audience,' added Dr Ryhänen.

For more information, please contact Cambridge Nanoscience Centre (www.nanoscience.cam.ac.uk) or Nokia (www.nokia.com/A4126506).



The Xen of start-ups

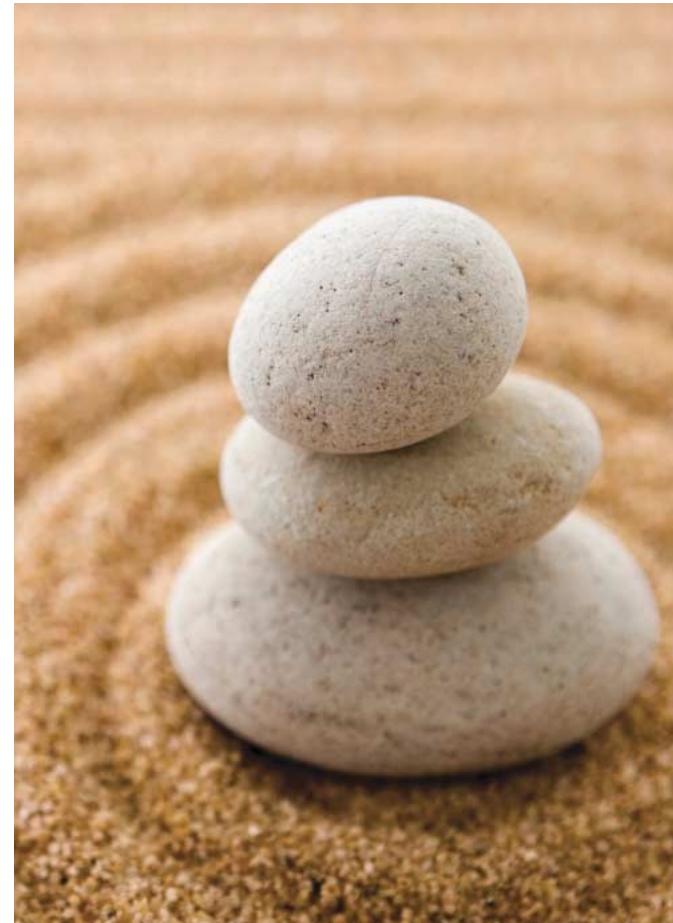
Acquired for \$500 million last year, a start-up that grew from research in the Computer Laboratory has just seen its first products being launched under the Citrix brand name.

A vision of how computers around the world could be used more efficiently through 'virtualisation' set a group of researchers in the Computer Laboratory on the trail of how best to deliver this technology. 'Our aim was to build a global commercial grid that would suit the dynamic and secure requirements of its users,' explained Dr Ian Pratt, who led the team. A decade later, the start-up company this yielded, XenSource, was acquired by Citrix for \$500 million and, a few weeks ago, the first Xen-based Citrix products were released.

The researchers' original ideas and scale of delivery for virtualisation were ambitious. 'Back then it was considered too radical to be funded,' said team-member Dr Steve Hand. The essential kick-start came when PhD student Keir Fraser decided to build the key component, a virtual machine monitor called a hypervisor. 'This was crucial since it provided a new level of operation: it was an umbrella under which many different operating systems could work, allowing users to run their own operating system and applications within,' said Dr Hand. 'What we were doing was breaking the link between software and hardware in a safe and secure way,' explained Dr Pratt.

The turning point came in 2002 when funding was secured from the Engineering and Physical Sciences Research Council (EPSRC) and the team published a seminal paper that is still one of the most widely cited articles in the field.

But just as importantly, the researchers released the software as open source under the GNU General Public License – anyone in the world now had the opportunity to use it free of charge. This turned out to be integral to the success of Xen. 'It allowed an enormous and growing academic and business community to work with the software. As Xen evolved, it was fed partly by the community that was using it,' said Dr Hand. With \$6 million funding from Silicon Valley, Drs Pratt, Hand, Fraser and Christian Limpach formed the start-up company XenSource, whose acquisition by Citrix was finalised late last year.



©CITRIX

'Research at the Computer Laboratory has a tradition of building something new from the ground up. These strengths gave us the resilience and expertise we needed to accomplish this,' said Dr Hand. Following the acquisition by Citrix, what's next for Xen? 'Xen for laptops and desktops...We'd love to see not only Xen on every server but Xen on every laptop and every mobile phone!' said Dr Pratt.

For more information, please contact Citrix (www.citrix.com) or Dr Steve Hand (Steven.Hand@cl.cam.ac.uk).

Exchanging ideas with China

Two recently funded grants will build and strengthen research collaborations with Chinese academics.

Cambridge is benefiting from two recent Arts and Humanities Research Council (AHRC) awards that share a common goal: the creation of interdisciplinary research networks between China and the West.

'Translations and transformations: China, modernity and cultural transmission', which launched in March in the Centre for Research in the Arts, Social Sciences and Humanities (CRASSH), aims to examine literary and cultural exchange between China and the West. 'Modernity is transforming the China of today. Two-way translation is crucial, not just in commerce and business but also in culture – in art, film and literature,' said Professor Mary Jacobus, Director of CRASSH. 'This raises issues about how the arts can be translated and transmitted between China and the West.'

'Narrascape: Urban environment as narrative system in the UK and China' launches in July in the Department of Architecture and builds on the strengths of its Digital Studio

in using digital media for studying architecture and cities. The project will examine urban places and experiences by investigating the role of human narratives in the fabrication of the urban landscape – using the camera as a tool to unravel how we experience the city around us. 'Urban environments in Cambridge and China are very different and, through a series of workshops, this will provide a fascinating cross-fertilisation of ideas between researchers,' said Dr François Penz, who leads the project.

'Projects such as these foster international links and build research capacity for all concerned in a highly productive way,' said Professor Jacobus. 'Chinese academics are as keen as we are to make connections and exchange ideas.'

For more information, please contact Professor Mary Jacobus (mlj25@cam.ac.uk) or Dr François Penz (fp12@cam.ac.uk).

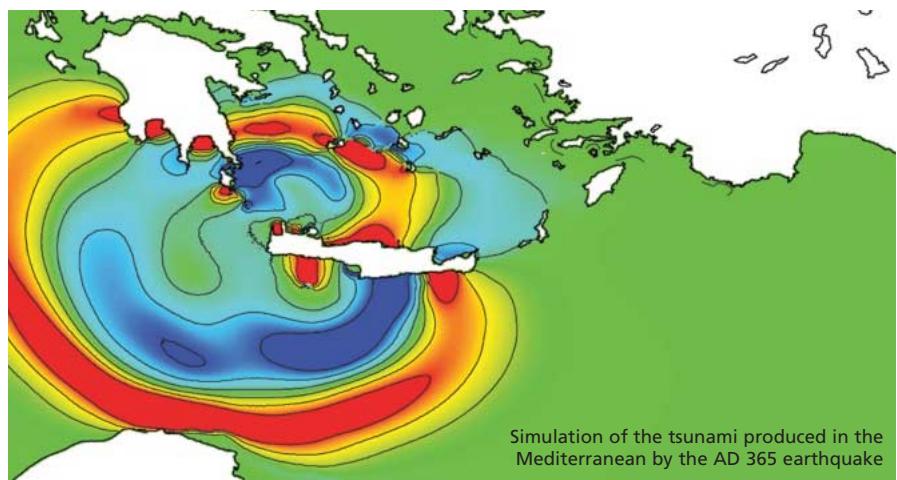
Tsunami risk in the Mediterranean

Research reveals the cause of an ancient catastrophe that could threaten the Mediterranean again.

On 21 July AD 365, an earthquake generated a tsunami that devastated the Nile delta, eastern Sicily and parts of the Adriatic as far north as modern Dubrovnik. In a recent article in *Nature Geoscience*, PhD student Beth Shaw from the Bullard Labs, Department of Earth Sciences, who led a team that included colleagues from the Universities of Oxford and Nice and Imperial College London, tracked down the fault that caused the earthquake.

'By carbon-dating corals we showed that in AD 365 a fault within the plate boundary along the southern edge of Crete uplifted the western part of the island by up to 10 m, leaving marks that resembled a bath-ring around the coastline,' said Beth Shaw. The fault that uplifted Crete also uplifted the sea floor, and it is this that generates a tsunami.

Calculations show that the tsunami would have had the characteristics



Simulation of the tsunami produced in the Mediterranean by the AD 365 earthquake

BETH SHAW AND PROFESSOR JAMES JACKSON

described by contemporary writers in the 4th century. The tsunami's height in the open ocean would have been about 60 cm, comparable to the tsunami from the 2004 Sumatra earthquake. The great destruction from these waves comes from their amplification when they hit shallow waters at the coast.

The researchers also demonstrated how rapidly the fault near Crete is accumulating strain energy today. 'If the entire plate boundary between western Greece and Turkey behaves in the same way, we might expect a similar earthquake and tsunami about every 800 years, and the last was in AD 1303,' said

Professor James Jackson, Head of the Bullard Labs. 'A repeat of the tsunami in the much more populated eastern Mediterranean of today would be a catastrophe. This work highlights the need to educate coastal populations in the Mediterranean so that they know what to expect and how to react when a big earthquake occurs.'

This work was supported by the UK's Natural Environment Research Council (NERC) and was published in *Nature Geoscience* (2008) 1, 268–276. For more information, please contact Beth Shaw (bs370@cam.ac.uk).

Cleaning up contaminated land

A recently launched project that unites academia with industry is addressing the need to decontaminate 'brownfield' sites for redevelopment.



© STOCKPHOTO.COM/MACHIN PRILL

Dr Abir Al-Tabbaa, Reader in Geotechnical Engineering at the Department of Engineering, provides the academic lead on a £1.24 million initiative that aims to develop a new technology for cleaning up the legacy of industrial contamination left in soil: heavy metals, petrol, tar, asbestos and other noxious waste. Remediation is needed both to protect the wider environment and to meet ever-increasing demands for housing and commercial developments on brownfield sites.

Project SMiRT (Soil Mix Remediation Technology) is the largest project funded by the Technology Strategy Board (TSB) on contaminated land remediation technologies to date. Leading the industrial component of the project is geotechnical contractor Bachy Soletanche, with the additional involvement of engineering consultancies, trade associations and materials suppliers.

'Making previously developed sites safe for new development is an important but costly process, with government targets set at building 72% of new housing on brownfield sites and upwards of £400 million per year spent

on remediation,' explained Dr Al-Tabbaa. 'The technology that we are working on with Bachy Soletanche aims to achieve significant technical advances that will reduce the cost and time involved in this necessary process.'

Over the course of three years, the project will develop an integrated advanced Soil Mix Technology by designing and manufacturing novel equipment and employing suitable materials that can simultaneously improve land quality and deal with pollutants. An important element of the project will be to take this technology forward through consultation meetings with stakeholders and a dissemination programme. 'This project is a unique opportunity to further develop soil mixing equipment in close parallel with materials technology,' said Peter Barker of Bachy Soletanche. 'The aim is to provide new, cost-effective solutions for both the contaminated land and ground improvement sectors.'

For more information, please contact Dr Abir Al-Tabbaa (aa22@eng.cam.ac.uk).

Outstanding scholars awarded

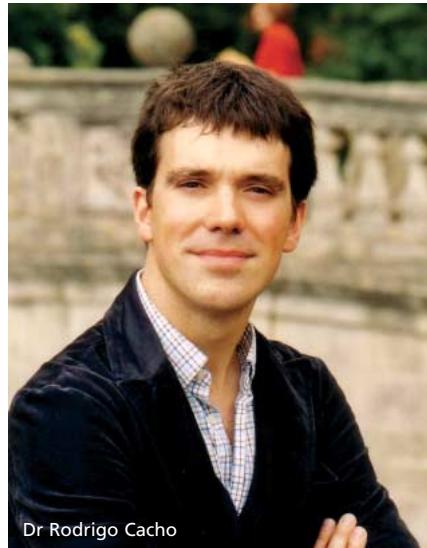
Two early-career academics in the Faculty of Modern and Medieval Languages have been recognised by the Philip Leverhulme Prize.



Dr Emma Gilby

Dr Emma Gilby from the Department of French and Dr Rodrigo Cacho from the Department of Spanish and Portuguese were honoured recently by The Leverhulme Trust for their outstanding research contributions: Dr Gilby for her meticulous scholarship of the 17th-century French literary-historical canon, and Dr Cacho for his research on Spanish Golden Age Literature.

During the tenure of their prizes, Dr Gilby will be working on 17th-century theories of indifference and free will, with particular reference to Descartes, and Dr Cacho will be editing the works of



Dr Rodrigo Cacho

Quevedo and writing a monograph on the Spanish mock-epic.

Approximately 25 Philip Leverhulme Prizes are awarded each year across five different topics, each prize providing £70,000 to enhance the prize-holder's research over a two-year period.

Professor Richard Hunter, Chair of the School of Arts and Humanities, is delighted for the two researchers: 'The prize is appropriate recognition for two outstanding early-career academics and a fitting testimony to the flourishing of research on European literature and culture in Cambridge.'

Cambridge Infectious Disease

A new initiative that aims to coordinate the University's commitment to tackling the global challenge of infectious disease was launched in April.

Infectious diseases are a threat to health, economic prosperity, social stability and security worldwide. Many internationally recognised research groups spread widely across departments and disciplines at the University of Cambridge are working in this area. 'A key objective of Cambridge Infectious Disease (CID) is to build capacity in infectious disease research and teaching by attracting new research partnerships and funding,' said Professor Duncan Maskell, Head of the Veterinary School and Chair of the CID steering committee. 'This initiative should enable and facilitate Cambridge researchers to have a greater impact on global health and quality of life.'

As part of the community-building vision of CID, its website provides a central reference point on infectious-disease-related research at Cambridge, as well as a searchable directory of researchers. To register and submit your research profile, please visit www.infectiousdisease.cam.ac.uk

BCA FILMS



Professors Ian White and Chris Lowe accept the prize from Her Majesty the Queen and HRH Prince Philip, Duke of Edinburgh, on behalf of the Institute of Biotechnology

how to ensure that entrepreneurial scientists can be nurtured within a well-managed academic environment.'

For more information, please visit the Institute of Biotechnology website (www.biot.cam.ac.uk). Professor Lowe is an Enterprise Champion for Cambridge Enterprise Ltd.

Institute of Biotechnology wins Queen's Anniversary Prize

The Institute has been recognised for its initiative, innovation and originality.

Since the establishment of the Institute in 1988, its ethos has been to provide a centre of excellence in biotechnology research and training within a flourishing entrepreneurial environment. The Institute has an annual research income of £3.5 million and has generated no less than nine spin-out companies – whose products range from glucose-sensing contact lenses for diabetics to hand-held devices for detecting food pathogens – with a

current market capitalisation of approximately £250 million. In 2005/6, 19% of the University's new UK patents were filed by members of the Institute.

The Institute's research activities are underpinned by an intensive Master's of Bioscience Enterprise (MBE) course that combines science, technology and business training. It is this unique combination of innovative multidisciplinary research, education and entrepreneurialism that has been recognised by The Queen's Anniversary Prize for Higher and Further Education, awarded at a ceremony at Buckingham Palace in February.

'Entrepreneurially inclined business-trained graduates rarely have sufficient fluency in science and technology to recognise opportunities or to gauge the intrinsic value of emerging developments in high technology,' said Professor Chris Lowe, Director of the Institute. 'The Institute of Biotechnology is a global exemplar of

China



**The Horizon Seminar
'China' takes place on
5 and 6 June 2008 at
Buckingham House,
New Hall, Cambridge.**

The latest Horizon spotlight falls on China, as we showcase the diversity and richness of China-related research and expertise at the University of Cambridge. This conference will highlight themes of culture, religion, education, literature and language alongside business, technology, economy and the environment. In bringing together academic and business leaders to share their knowledge and experience, this event will be a unique opportunity to discover China from a variety of perspectives. Join us to meet many individuals and organisations who are keen to deepen their understanding of this complex and fascinating country.

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



A TRADITION OF SCIENCE AND INNOVATION (5 JUNE)

Scientific innovation in China provided the world with inventions such as printing and papermaking. We will explore some of this rich history and discover how traditional Chinese materials and medicines are being re-examined for their modern applications.

Professor Christopher Cullen
Needham Research Institute
Jim Platts
Institute for Manufacturing
Dr Tai-Ping Fan
Dept of Pharmacology
Professor Peter Williamson
Judge Business School

CHINA'S GLOBAL INFLUENCE (5 JUNE)

Globalisation is not a new concept to the Chinese. In this session we will hear about the country's long diplomatic tradition and its experience of globalisation. We ask: how is China responding to the new challenges of the 21st century?

Professor Hans van de Ven
Dept of East Asian Studies
Dr Sally Church
Dept of East Asian Studies
Dr Andreas Kontoleon
Dept of Land Economy
Dr Jin Zhang
Judge Business School

UNDERSTANDING CHINA (6 JUNE)

This session will address Chinese society and identity through wealth and poverty, ageing, food and post-war cinematic culture. Speakers will shed light on these areas through an exploration of historical and current perspectives.

Professor Roel Sterckx
Dept of East Asian Studies
Dr Uradyn Bulag
Mongolia and Inner Asia Studies Unit
Dr Barak Kushner
Dept of East Asian Studies
Dr Anna Boermel
Dept of East Asian Studies
Dr Pei-Yin Lin
Dept of East Asian Studies

COLLABORATING WITH CHINA (6 JUNE)

China continues to experience an unprecedented economic development in the 21st century. The speakers in this session will explore how we can collaborate with China in science, education, technology, innovation and policy, working together to find solutions for global problems such as the environment and sustainability.

Dr Paul Irwin Crookes
Centre of International Studies
Dr Jag Srai
Institute for Manufacturing
Pingping Dou
Dept of Architecture
Chris Cotton
China-Britain Business Council

Jade: the 'Stone of Heaven'

Treasured and venerated for thousands of years, jade holds a special place in the history and culture of the Chinese Empire.

China is unique in the degree to which it has assimilated jade into its rituals, its religion and its art. Jade has been regarded historically as possessing mystical powers to ward off evil, and was considered by many as a metaphor for longevity, wisdom and purity. It is perhaps no surprise that the Mandarin character for jade, *yu* 玉, symbolises the linking of heaven and earth.

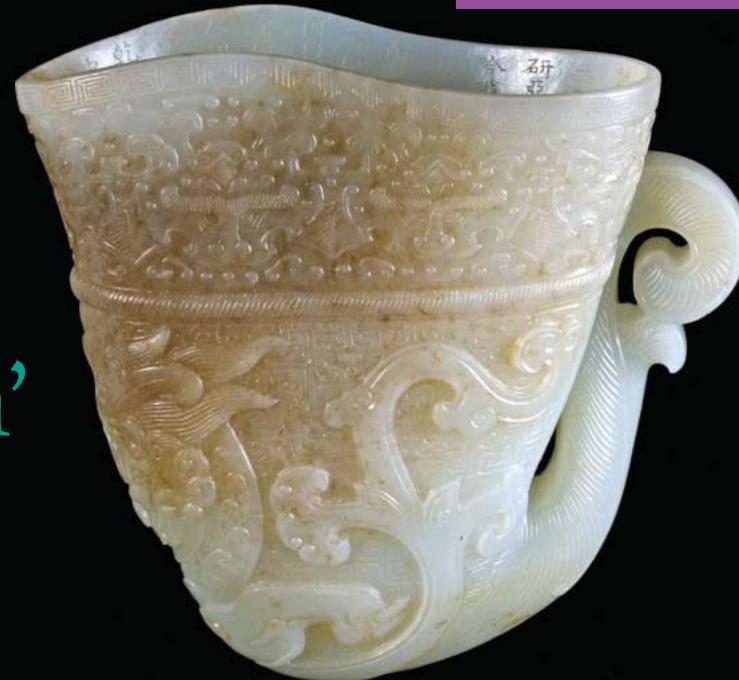
The Fitzwilliam Museum houses about 200 jades and other hardstones covering almost the whole of Chinese history from the Neolithic to the 20th century.

Dr James Lin, Assistant Keeper of Applied Art in the Museum, and affiliated to the University's Faculty of Asian and Middle Eastern Studies, has been researching the history of the collection. With funding from the British Academy, Dr Lin has travelled to different parts of China to view excavations of ancient tombs and to discuss the Museum's jade collection with curators and scholars. The result will be a full catalogue of the collection to be published in early 2009.

By Royal appointment

Ownership of jade was a privilege of the richest members of society, particularly the Imperial family. The Museum collection includes several pieces that belonged to the Emperor Qianlong, who reigned AD 1736–1795, and was the fourth Qing Emperor to rule over the Manchu Empire. An art lover, collector and sponsor, his love of jade inspired him to compose thousands of poems about the stone.

After pacifying the rebels in Xinjiang province in 1758, the Qing court gained access to jade from Khotan. The jade was mined and carefully shipped to Beijing to be carved in the Imperial workshop. Qianlong often emphasised in his poems



Jade rhyton, 1787 (Oscar Raphael bequest); below, Jade disc, c. 3rd–1st century BC (Oscar Raphael bequest)

that jade should not be wasted on common craftsmen – only the most skilled practitioners, capable of amazing feats of beauty, should be allowed to fashion works of art from the jade. A typical example in the collection is a horn-shaped drinking cup known as a rhyton. Dr Lin's research has found an imperial document recording that it was presented to Qianlong for approval in 1787 and that he ordered a poem, still visible today, to be incised around its inner edge.

The lost poem

As well as being used to create trinkets and gifts, jade was used in death for ritual objects buried in tombs. Excavation of tombs from the Han dynasty (BC 206–AD 220) has uncovered superb jade suits used to encase the bodies of Imperial family members. One such object held in the collection – a jade disc used to cover the body of a high-ranking individual – has yielded a fascinating history. Dr Lin recently discovered a poem incised along its rim. Because of the greyish-green, brown-speckled colouring of the disc, and the tiny edge along which it was inscribed, the poem had long been missed, perhaps for centuries. But rather than the poem being an original inscription, research showed that this was yet another example of Qianlong's love of artistry in jade: he believed that this disc was used as a ritual object to sacrifice to the deities and added the poem in 1769, after it became part of his collection.



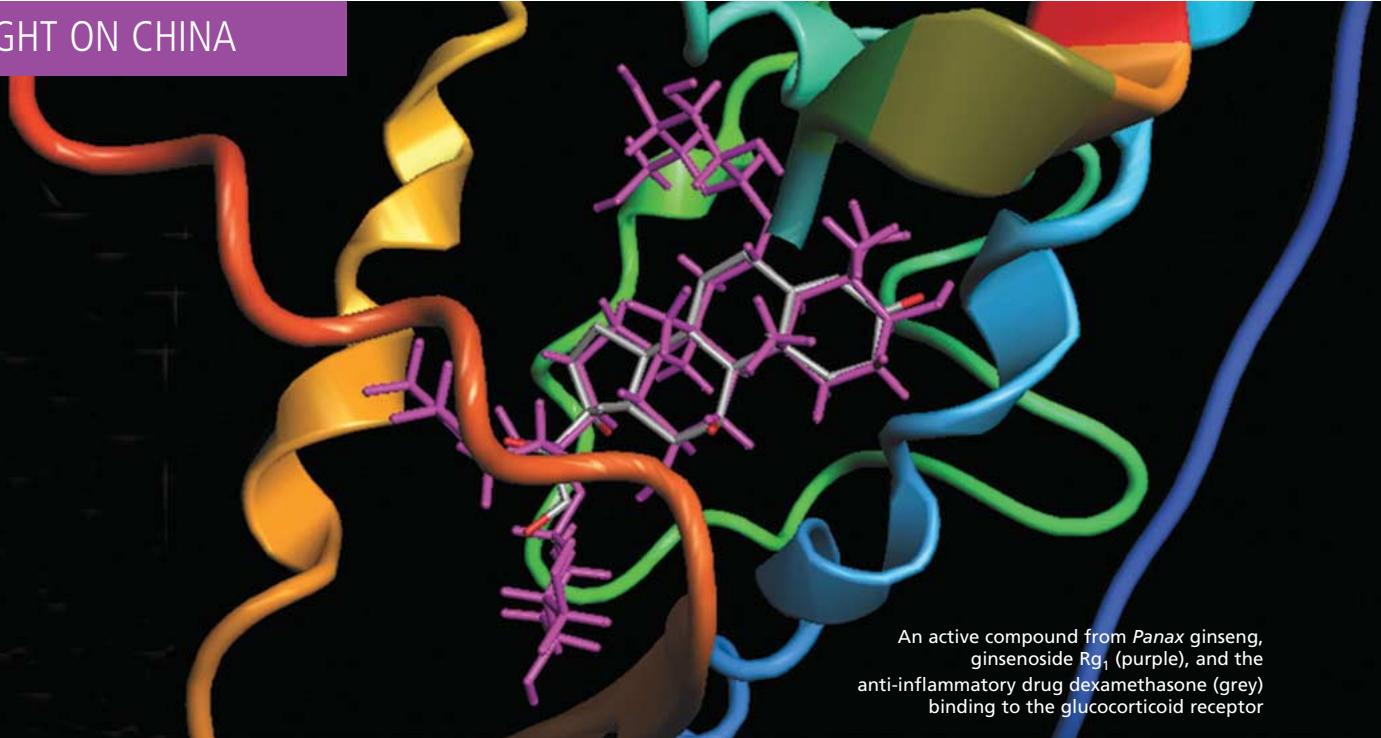
This discovery is all the more compelling for its demonstration that objects may lose their original function and meaning once they have lost their original context. As the rest of the collection is catalogued, further remarkable stories of jade in China are sure to unfold.

For more information, please contact the author Dr James Lin (jcs13@cam.ac.uk) at The Fitzwilliam Museum.

A small selection of jades from the Qing Imperial collection will be displayed in The Fitzwilliam Museum's Chinese gallery during May and June 2008 in association with CHINA NOW – the UK's largest ever festival of Chinese culture. An exhibition of Chinese jades will be held in the Museum's Octagon Gallery from late January–May 2009. The Museum is seeking corporate support for the exhibition and catalogue; please contact the Development Officer, Sue Rhodes (sr295@cam.ac.uk).



Dr James Lin



An active compound from *Panax ginseng*, ginsenoside Rg₁ (purple), and the anti-inflammatory drug dexamethasone (grey) binding to the glucocorticoid receptor

Research led by the Department of Pharmacology is discovering the drugs of tomorrow from traditional Chinese medicine.

Almost every culture has its distinct herbal traditions, each with its indigenous plants and unique practices. But one premise unites them all – herbs have remarkable properties that make them potentially powerful medicines. In Britain, this rich history was given credence in 1511 by the *Herbalists Charter of Henry the VIII*, which stated that anyone 'having knowledge and experience of the nature of herbs, roots and waters' was allowed to provide care. In China, practitioners of traditional Chinese medicine (TCM) began to compile formulations in compendia more than 2000 years ago. Today, TCM is enjoying a revival, thanks to several international initiatives to validate the power of TCM as a preventive medicine and as a cure for chronic diseases.

Fascinated by the ground-breaking work in the 1990s of dermatologists and TCM practitioners using Chinese herbs in the treatment of steroid-resistant eczema, Dr Tai-Ping Fan embarked on a quest to transform the art of TCM into a rigorous evidence-based science of healthcare and well-being. Ten years on, his team at the University's Department of Pharmacology is now working on an interdisciplinary programme to discover new medicines from plants.

The good and the evil of *materia medica*

An incredible 400,000 combinations of 10,000 plant and animal extracts plus minerals make up the formulations of

Unlocking Nature's biochemical secrets

TCM known today. Chinese doctors are guided by holistic principles and often prescribe a cocktail of *materia medica* (*fufang*) with the aim of promoting synergistic interactions among constituents yet minimising their adverse/toxic effects. In fact, such a practice of polypharmacy has now become a popular approach for modern-day drug formulations: some 'All-in-One' products for the relief of cold symptoms, for example, contain a mixture of paracetamol (to treat headache, shivers and pains), phenylephrine (blocked nose and sinuses) and guaiifenesin (chesty coughs). Establishing which are the active ingredients and which are the toxins, and determining how they work, is key to the renaissance of TCM as a means of drug discovery.

Yin and Yang in ginseng

Dr Fan's research has focused on the time-honoured herb ginseng (*Panax*), a commonly used nutraceutical (a food extract that has medicinal effects) and one of the most important components of TCM. Variously attributed with benefits such as improving alertness, inducing well-being and reducing pain, ginseng has been shown in recent times to aid wound healing and treat tumours. But, perplexingly, the plant seems to act both by promoting the growth of blood vessels (angiogenesis) in wounds and by inhibiting it in tumours. How can it accomplish such opposing activities?

'In these days of huge international pharmaceutical companies and modern high-powered methods of drug development, it is worth recalling how much we owe to compounds discovered in the natural world through folk medicine.'

Professor Peter McNaughton,
Head of the Department of
Pharmacology

Using pure molecules extracted from the plant, Dr Fan led an international team of researchers from Massachusetts Institute of Technology, Gaubius Laboratory in The Netherlands, Hong Kong Baptist University and the University of Cambridge to study this phenomenon. By determining ginseng's chemical fingerprint (the chemical 'signature' of molecules that distinguishes one compound from another) and purifying its components, the team has reconstructed what is happening to the blood vessels at both the cellular and molecular level.

Not all ginseng is the same

One of the principal findings of the study is that not all types of ginseng are the same: the source is vitally important. A mass spectrometric compositional analysis of American, Chinese, Korean and Sanqi ginseng revealed distinct fingerprints, especially in the ratio between the two most prevalent constituents, the 'sterol ginsenosides' Rg₁ and Rb₁. Crucially, if the ginseng has Rg₁ as the dominant constituent it promotes angiogenesis, and if Rb₁ is dominant it exerts an opposing effect. For the first time, the ambiguity in the effects of ginseng on vascular pathophysiology had been explained by the specific make-up of each variety.

Working with Professor Ricky Wong at Hong Kong Baptist University, Dr Fan has taken his research a step further. Homing in on the molecular interactions happening inside the blood vessel cells, the research has confirmed precisely how ginseng works. Rg₁ binds to a steroid receptor (glucocorticoid receptor), which then stimulates blood vessel growth by upregulating a growth factor; by contrast, Rb₁ binds another type of steroid receptor (oestrogen receptor), which then inhibits blood vessel growth through a different pathway.

These discoveries highlight the potential benefits of the components of ginseng for drug development. They also raise important implications for TCM and regulations that standardise herbal therapy: incorrect identification and misuse of herbal species can result in severe consequences and extreme care must be taken that the right herbs are prescribed for the right condition.

Herbs for health

These new aspects of angiogenesis research are providing important clues for the development of novel drugs to treat diseases in which angiogenesis plays a role, including rheumatoid arthritis, heart disease, psoriasis, chronic wounds and cancer. Working closely with Dr Rik van Veen in the Department of

Pharmacology, Dr Fan aims to discover herbal activities for the reversal of multi-drug resistance in cancer chemotherapy. A further collaboration is studying other herbs commonly used in TCM for the prevention and treatment of cardiovascular conditions such as hypertension and stroke (*Salvia miltiorrhiza*, or danshen), and gynaecological disorders such as irregular periods and endometriosis (*Angelica sinensis*, or dong quai). This project brings together expertise from many departments: Professor Steven Ley (Department of Chemistry), Dr Stephen Charnock-Jones (Department of Obstetrics and Gynaecology), Dr Bertie Göttgens (Department of Haematology), and Professor Kevin Brindle and Dr Richard Farndale (Department of Biochemistry).

Modernising Chinese medicine

The multifactorial nature of chronic diseases is one of the most significant problems in drug discovery today. Orally active Chinese medicine *fufang* represents a golden opportunity for drug discovery: each herb contains many active ingredients and is essentially an enormously complex chemical cocktail with medicinal properties that modern pharmaceuticals cannot yet reproduce. Internationally, drug discovery researchers are increasingly turning to TCM. One of the most ambitious of these projects was announced only recently: the 'Herbalome Project' at the Dalian Institute of Chemical Physics in China is embarking on a 15-year study using high-throughput screening, toxicity tests and clinical trials to identify the medicinal constituents of herbal preparations.

In Britain, Dr Fan has assembled a consortium of experts from the University of Cambridge, the Needham Research Institute in Cambridge, the Royal Botanic Gardens at Kew, Brunel University, Bradford University, the London School of Pharmacy, and Guy's & St Thomas' NHS Foundation Trust. In collaboration with Chinese government agencies, academic institutions and enterprise, the consortium aim to illuminate the science underpinning TCM theories and practice, and deliver solutions for new avenues of healthcare.

Cambridge is well placed to become an international centre for the systematic investigation and modernisation of Chinese medicine in the future. The drawing together of expertise and resources across the University and neighbouring institutions, and the formation of joint ventures with pharmaceutical and biotech companies, will ensure the power of modern science continues to unlock Nature's biochemical secrets.



Preparing traditional Chinese medicine; illustration from *Handbook of the Supplement to Leigong's Methods of Preparing Medicine* (c.1590s)



Dr Tai-Ping Fan

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Tracing the history of modern globalisation in China

A Sino-British project is examining the history of China's first age of modern globalisation, enabling China and Britain to rediscover their interconnected past.

Walking through the streets of Shanghai today, you see a city full of dynamism, enterprise and quirky creativity, a 'must visit' place that draws talents from across China and the rest of the world. Yet, in the mid-1980s you would have been struck by the fact that the former 'Paris of the East' seemed a gothic ruin, a melancholy reminder of a past that China had turned against after the 1949 victory of the Chinese Communist Party. China's recent rapid take-off into globalisation, only a few short years after Deng Xiaoping, Mao Zedong's successor, instituted the policy of 'reform and open up', shows that China was never entirely a closed country. History shows that wave after wave of foreign goods, people and ideas have rolled into China, been absorbed, and in turn have transformed its economy, patterns of consumption, lifestyles, imaginative life, architecture and spatial organisation.

Professor Hans van de Ven, Chair of the University's Faculty of Asian and Middle Eastern Studies, has been researching a key resource in tracing the history of modern globalisation in China: the Chinese

Maritime Customs Service. In its almost century-long history between 1853 and 1950, the Customs Service kept records detailing how the key globalising commodities of the time – opium, sugar, kerosene, tobacco and arms – spread through China and were taken up differently in its regions. This little-studied institution was at the heart of China's encounter with globalisation in the years between the Taiping Rebellion of the 1850s and the Communist assumption of power. The 'in-between' nature of the Customs, at the interface between China and the rest of the world, has provided a remarkable opportunity to examine how globalisation played out in the century before China was closed off from the rest of the world in the 1950s.

Seeded by a serendipitous encounter

In the late 1990s, while Professor van de Ven was studying documents at the Second Historical Archives of China in Nanjing, a chance conversation with Vice-Director Ma Zhendu led to him hearing about the recent acquisition of 55,000 files from the Customs that had just arrived by train from various parts of China. Out of this has grown a fruitful collaborative project involving historians in China and Britain that continues today.

Initial funding for the project came from the Chiang Ching-kuo Foundation, an organisation for international scholarly exchange that supports

and promotes the understanding of Chinese culture and society overseas. This allowed the cataloguing of all 55,000 files in the archives; an effort that took a team of four Chinese archivists four years to conclude. Professor van de Ven and his collaborator, Professor Robert Bickers of the University of Bristol, simultaneously compiled databases from Customs data on China's international trade, wages and arms trade. In 2003, an Arts and Humanities Research Council (AHRC) Major Research Grant allowed the employment of a research assistant and the recruitment of two PhD students. The project is now in full swing, with a website in operation (www.bristol.ac.uk/history/customs), monographs being produced, guides to the archives being completed, databases in the final stages of verification, and 350 reels of microfilms now published to enable researchers worldwide to make use of the archives.

A unique institution in Sino-British history

The Customs was founded in Shanghai at the time when the Taiping Rebellion against the authority of the Qing government raged inland, and a local uprising drove Qing Dynasty officials out of the city in 1853. Bound by treaty obligations to ensure that foreign merchants fulfilled their tax obligations, the British, French and US consuls stepped in. They established a foreign board for the local Customs Stations to enforce

Flag flown by Customs Cruisers, Boats, Lightships, Lighthouses and 'all other kinds of Customs property where the use of a flag is befitting' 1873–1889



Huangpu River, Shanghai, from a China Navigation Company steamship, 1906–7; G W Swire: Swire collection, SOAS (sw12-086)

trade tariffs. Although intended as a temporary measure, out of this small beginning grew a huge organisation whose influence rippled out across China and to the rest of the world.

The Customs managed nearly 60 harbours along China's coast and rivers; collected about a third of the entire national revenue; established China's national postal service; financed China's legations abroad; assembled its contributions to international fairs and exhibitions; funded a Quarantine Service to protect China from pandemics; formed China's coastguard and railroad police; and supported scholarly enterprises such as the translation of Western textbooks on political economy and international law.

Unique in many ways, the Customs was the only integrated national bureaucracy that continued to function through the many civil wars and foreign invasions that preceded the establishment of the People's Republic of China. Although the Customs was always a Chinese organisation, foreigners dominated its upper echelons in rough proportion to a country's significance in their trade with China. As Britain was the dominant trade partner, the Head of the Customs was British until the final few years of the institution, when it was led by an American. A cosmopolitan mix of French, British, Russian, German and Japanese staff worked together in the Customs, even as their countries went to war elsewhere or their armies invaded China.

Researching the files has yielded details of the complex roles that the

foreigners performed within the institution. During the Boxer Rebellion of 1900, Sir Robert Hart, the Head at the time, secured the food supply to the city and effectively knocked foreign and Chinese heads together to end the fighting and restore central administration, thus helping to prevent the country's dismemberment. (Unfortunately, he also negotiated an indemnity that crippled China financially for many years.)

The Customs was a pillar of foreign privilege in China, but China's rulers also used 'foreigners to control foreigners', establishing Customs Stations with foreign Commissioners along China's borders as bulwarks against foreign encroachment. Because of this role, Custom Houses appeared in some rather odd places, including along the mountainous border with Burma and the arid deserts of Xinjiang, as well as between Chinese and Japanese frontlines deep in inland China during the 1937–1945 War of Resistance against Japan.

More than a collector of taxes

The Customs was always much more than just a tax collection agency. It was well informed about local conditions, deeply involved in local, provincial and national politics, and also in international affairs. To some extent, its influence is still felt today. China's Custom Houses and lighthouses often occupy the same place as those before 1949, sometimes still operating from the same buildings. Hosea Ballou Morse, one of the Chinese Customs Commissioners, and his wife were avid botanists whose samples

continue to enrich Kew Gardens and helped make China's flora popular in Britain. Many foreign Customs officials learned Chinese, wrote on Chinese history and translated Chinese books, some of which are still read today. As Chinese Studies became established as an academic discipline, universities around the world recruited Customs scholars: indeed, the founder of the Chinese Maritime Customs Service, Sir Thomas Wade, was the first Professor of Chinese at Cambridge. By tapping into the vast resources of the Chinese Maritime Customs Service, this research project is casting a fascinating historical perspective on the history of globalisation in China.



**Professor
Hans van de Ven**

For more information, please contact the author Professor Hans van de Ven (jv10@cam.ac.uk) at the Department of East Asian Studies, or see the project website (www.bristol.ac.uk/history/customs), which was created by Professor Robert Bickers and hosts research tools and publications.

Globalisation today: Chinese big business

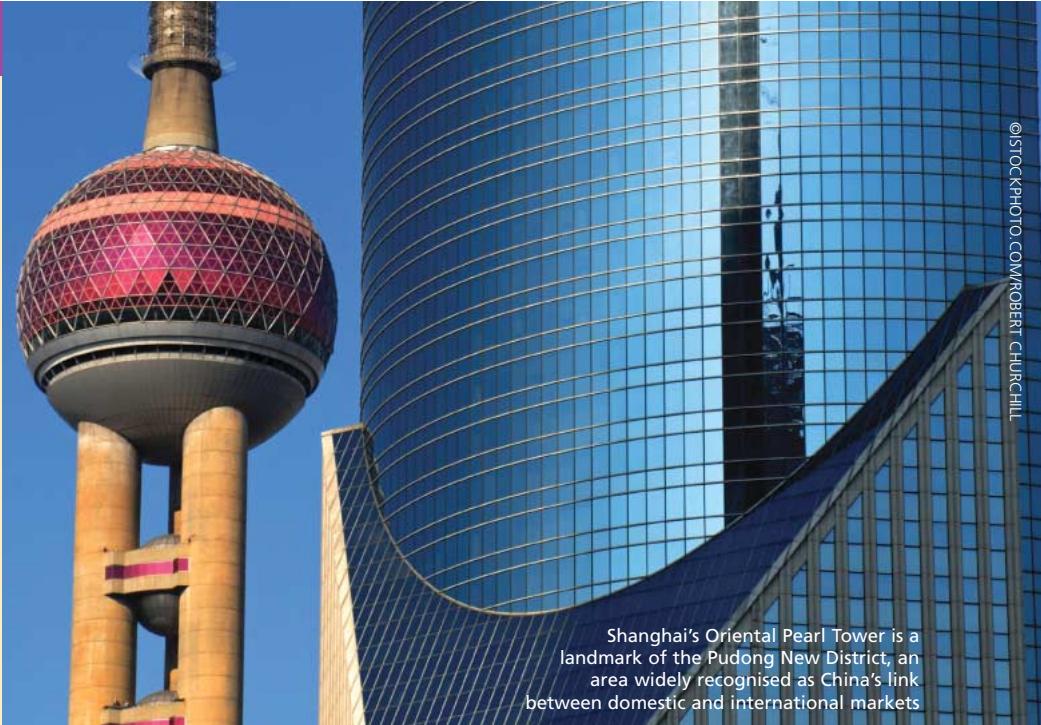
This year is the 30th anniversary of China's policy of 'reform and open up'. What has happened to China's strategic industries and how competitive are Chinese big businesses today?

China began liberalising the post-Mao economy in the late 1970s, when the world was embarking on a course of globalisation, forming close international trade and business links. Since the country began to integrate with the world's economic and business systems, a consistently stated goal of China's industrial policy has been to construct internationally competitive companies.

Dr Jin Zhang at Judge Business School has been closely studying the transformation of China's strategic industries – aerospace, oil, telecommunications equipment and, most recently, banking – in the epoch of globalisation. Through extensive field work and in-depth case studies, her research explains China's attempt in a rapidly changing international business environment to build its own internationally competitive firms, many of which are state owned and still central to China's economic and political system.

Revolution versus evolution

In the past three decades, the world's leading firms have undergone a *revolutionary* transformation, often described as the 'global business revolution'. In order to survive and prosper, the nature of large firms based in high-income countries has had to alter greatly. Business and organisational structures have been fundamentally changed through mergers and acquisitions, facilitated by advances in information technology. In almost every sector, a small number of focused global producers have occupied the majority of the global market share, and this process has been cascading down their supply



Shanghai's Oriental Pearl Tower is a landmark of the Pudong New District, an area widely recognised as China's link between domestic and international markets

chain. The result is that leading firms in almost every industrial sector have become 'conductors of an orchestra', bringing together their supply chain to compete as a system in the world market.

By contrast, in the same period, China's large firms have undergone more of an *evolutionary* process of restructuring, responding to the challenges of the global business revolution. They have made progress in improving operational mechanisms and corporate governance systems and have gained substantial understanding of international financial markets through public listing. They have become sought-after joint venture partners for global leading firms. However, they have also encountered a wide array of problems and difficulties associated with the transition of the vast economy.

With forces of globalisation and transition also at play, the attempt to construct competitive large firms in China has been all the more challenging. Indeed, when China joined the World Trade Organization (WTO) in 2001, China's large firms in strategic industries lagged behind the world's leading firms in each of the sectors.

The future is dynamic

The first phase of China's attempt to develop large competitive firms in strategic industries was about introducing market forces. Now, China has entered the second phase of industrial restructuring. It is learning lessons from the global business revolution and is trying to construct effective industrial policy in the post-WTO era. Through a combination of state industrial policy and

market mechanisms, China is consolidating firms in the strategic industries. Instead of breaking the country's 'big four' state-owned banks into smaller entities, each of these four banks has restructured into share-holding companies and has successfully listed on international markets in the past five years.

China is also in the process of consolidating its aerospace industry, led by the project of producing a 'big commercial jet' in the next 20 years. These developments have been closely watched by leading global firms. The intertwining of changes in China's internal business system with the revolution in large global firms has always been a protracted and complicated process. It is far from over. Interesting times lie ahead in the study of the development of China's large firms in strategic industries as the country explores its way between state and market: the future is truly dynamic.



Dr Jin Zhang

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'Noodle-ology': the politics of cuisine



Inside a contemporary ramen shop in the south of Japan

**Food history breaks down our understanding of national borders:
Barak Kushner is examining how interactions between China and Japan have shaped modern Japanese cuisine.**

Often regarded as the emperor of modern cuisine in Japan, ramen (a savoury noodle soup that takes half a day to prepare) accounts for approximately 26% of all meals eaten outside the home in Japan. Ramen restaurants dominate the urban and rural landscape. There are ramen museums, as well as ramen-dedicated comic books, rock songs, TV contests, magazines, websites and even a scholarly journal.

Instant ramen, invented in 1958 as an antidote to post-war malnutrition, is even more popular and has made ramen an international food. Currently, the world consumes over 65.2 billion packages of instant ramen a year, with over 200 different varieties to enjoy.

But ramen is not a true Japanese national dish as many would believe. To understand ramen's cultural and economic influence in the international scene, Dr Barak Kushner, from the Department of East Asian Studies, is charting the history and shifts in food culture across East Asia. The real story is the cultural development, the travels, the people and the events that formed how the Chinese and Japanese ate.

Noodle soup: a force of history

Dr Kushner's analysis of Chinese and Japanese menus, Imperial diaries, travelogues, government archives, military reports, science magazines and ancient food treatises suggests that what we insist belongs to 'Chinese cuisine' or 'Japanese food culture' is flawed.

Historically, the Japanese ate little meat, little oil and very little spice, but in the early 20th century the national cuisine

began to change in response to cultural and political drivers, ultimately re-shaping national identity through food culture. At this time, labour unions were growing in strength and were attempting to secure better wages and a reasonable workday; caloric and inexpensive dining had become a necessary ingredient for urban expansion.

After much iteration, ramen entered the Japanese market as a cheap meal for itinerant peddlers, wage labourers and poor students. Chinese students living in Japan were one of the largest foreign groups, greatly influencing lower- and middle-class restaurant offerings in urban areas. After the Sino-Japanese War in 1895, they came in increasing numbers to study how Japan modernised so quickly. Students as well as labourers flocked to the new communities and their growing economic surge created new food demands.

This symphony of new tastes, combined with the need to eat out, and influenced by Japan's expanding empire, spurred the opening of new restaurants that offered a cuisine not formerly found in Japan. For example, in 1911, the owner of the Takeya Cafeteria in Sapporo, in the extreme north, hired a Chinese cook who created a stew-like dish with meat, broth and springy noodles, calling it 'Shina soba', or Chinese noodles.

Other restaurants around the country began to offer similar fare but it was not until the post-war era that the dish became known in Japanese as ramen. Much later with the export of instant ramen the dish took on its new nationality.

Political revolutions are menu revolutions

Believing ramen to be a timeless Japanese dish is similar to the misconception that fish and chips is a long-time traditional British meal. In both cases, the dishes actually evolved from early 20th-century social and political changes that deeply altered the landscape of their respective national cuisines and, until recently, were not distinctive features of either culture. Dr Kushner's research suggests that, contrary to that popular saying, we are probably not what we eat.



Dr Barak Kushner

For more information, please contact the author Dr Barak Kushner (bk284@cam.ac.uk; www.barakkushner.net) at the Department of East Asian Studies, or see his forthcoming book *The Noodle that Changed the World* (Hurst Publishers). The author thanks the Freeman Foundation in the USA and the Japan Foundation Endowment Committee in Britain for their support.

Making sense of the cosmos in ancient China

China's rich history of scientific and technical contributions to human culture stretches back to antiquity, as Christopher Cullen has been discovering when it comes to numbers.



Bamboo strips of the *Suan shu shu* 算數書 'Writings on Reckoning'

The idea that the material world can be understood through numbers, patterns and mathematical laws was one of the most fruitful departures in the intellectual history of mankind. But when and how did that departure take place? For some, the answer goes back to the ancient Greeks – and amongst the Greeks themselves, Aristotle looked back to the disciples of Pythagoras who, he says,

'thought the principles [of mathematics] were the principles of all things' (*Metaphysics*, Book 1). The research interests of Professor Christopher Cullen, of the Needham Research Institute in Cambridge and the Faculty of Asian and Middle Eastern Studies, look in a different direction – to ancient China – to discover other evidence of humanity's early efforts to make quantitative sense of the cosmos.

Preserving harmony and order

The Chinese Empire began with the unification of a collection of culturally related but often quarrelsome states on the East Asian mainland by the First Emperor of the short-lived Qin dynasty (BC 221–207), whose rule was succeeded by the four centuries of the Han dynasty (BC 206–AD 220). Numbers mattered vitally to the new centralised state's view of what was needed for order to be maintained, both in relation to the universe and in everyday life.

When it came to relations between the human world and the impersonal powers that underpinned the regularities of the cosmos, the lead human actor was the Emperor himself, who performed annual rituals to ensure that the harmony of the cosmos was preserved. To ensure he did the right thing at exactly the right time, a permanent staff of sky-watchers and calculators, equipped with the best instruments available, were tasked by the Imperial Chinese government to set up systems to predict all predictable celestial events – from new moons, solstices and equinoxes, to the motions of the planets.

But it was not only at the top of the Chinese state that numbers were supremely important. Much of the life of an ordinary official consisted of quantitative management of physical resources such as grain, labour and time. All of these required the use of calculation techniques that were often considerably more than simple addition and subtraction. Our understanding of the importance of these techniques in official life has been immensely deepened by the discovery of a collection of material written on 190 bamboo strips in the tomb of a provincial official who died in BC 186. This collection bears the label *Suan shu shu* 算數書 'Writings on Reckoning' and is the oldest known Chinese text on mathematics.

Professor Cullen's translation of this collection has shown that its 7000 characters explain mathematical techniques ranging from elementary fractions through to methods for solving problems that would nowadays be formulated as linear algebraic equations. One obsession of the ancient official mind that pervades this collection is the need to control every activity in the minutest detail. A fascinating example describes the most mathematically efficient use of time for a man working in the forest making charcoal. In one day he produces seven bushels of charcoal, but if the next day he carts it all to the Charcoal Office it would only take him 7/10 of a day's work, leaving him with 3/10 of a day free – clearly an intolerable situation. The calculations recommend that he should work for 10 full days

producing charcoal and for seven full days carting it. Just as there was to be order and predictability in the heavens, so it was to be on Earth.

Celestial software

Detailed contemporary accounts of the predictive systems constructed by early Chinese astronomers – in effect, ancient computing programs – are preserved in historical sources. These include the Han astronomical system (*Han li* 漢曆) officially adopted in AD 85, whose procedures Professor Cullen has translated into modern-day Excel spreadsheets. At the tap of a key, these astronomical systems, made nearly 2000 years ago, will calculate all the solar, lunar and planetary data for any given year since.

Impressive as this is, the records of the Chinese astronomers go further than simple predictions. Often these historical accounts also furnish the evidence and reasoning that led to the adoption of new (and hopefully improved) systems from time to time. They provide fascinating evidence of such fundamental innovations as the adoption of the ecliptic (the path that the Sun traces out in the sky) as a reference system and the discovery of the varying apparent speeds of the Sun and the Moon. Remarkably, these full Chinese records begin at an earlier stage of astronomical sophistication than found anywhere else in the world.

A 'Theory of Everything'

The first Chinese astronomical system for which full documentation has been found is the *San tong li* 三統曆 'Triple Concordance System', which was elaborated by the scholar and statesman Liu Xin around AD 10. As well as specifying his 'computing program', Liu Xin wrote a lengthy treatise explaining the rationale behind it. His celestial predictions were derived from numbers that were (in his view) basic to the cosmic order. The ambition was clear: a Grand Universal Theory of Everything. In fact, Liu Xin's predictions are strikingly accurate. His theoretical value for the mean length of a lunar month was 29.5309 days, not far from the modern value of 29.5306 days; the error amounts to no more than one hour in 139 months. At the other end of the world, the Pythagoreans would certainly have agreed that Liu Xin was on to something!

The place of numbers

Professor Cullen has recently been looking into the broader question of who studied methods of calculation in early Imperial China – who taught whom, and why? One fascinating point

that emerges from this enquiry is that the first historically identifiable teacher-pupil pair in this area was female. The teacher was the great scholar Ban Zhao (c. AD 45–114) and the pupil was the Empress Deng (AD 80–121), who as a girl was so obsessed with books, to the exclusion of all interest in 'women's work', that her exasperated mother once exclaimed 'Are you going in for a doctorate?'

It is around the time that the Empress took her supervisions from Ban Zhao that some scholars date the compilation of the first systematic Chinese book on mathematics extant today, the *Jiu zhang suan shu* 九章算術 'Mathematical Methods in Nine Sections'. The compiler of this book is unknown. Could it have been a teaching aid designed by Ban Zhao for her Imperial pupil? The speculation is an intriguing one.

There is certainly much more to be settled about the place of numbers in ancient Chinese thought and practice. The answers should help us to understand an important part of the intellectual history of the whole of humankind.



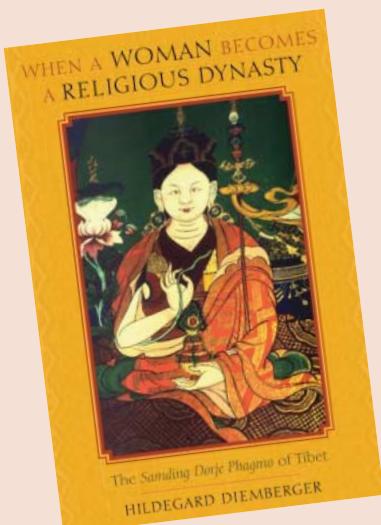
**Professor
Christopher Cullen**

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When a woman becomes a religious dynasty

A rare Tibetan manuscript – a treasure that had remained hidden for centuries – set in motion a journey by Hildegard Diemberger that was to bring alive the still-unfolding story of a 15th-century Tibetan princess.



I first heard tales of the remarkable princess Choky Dronma – famed for her daring exploits, cultural and social innovation, and unusual powers – during long evenings spent in the Tibetan monastery of Samding over a decade ago. The monks told me how she had miraculously founded the monastery in the 15th century and how her spiritual leaders had revealed that she was the human embodiment of a deity they gave the title Dorje Phagmo. They showed me her image among the mural paintings that decorated the newly reconstructed monastery and explained how, after her death, her disciples recognised a young girl as her reincarnation, so commencing a lineage of female incarnations that is recognised today.

Two years later, in New York, the legendary scholar of Tibetan studies Gene Smith showed me a copy of the biography of the same princess recorded by her disciples in the wake of her death. It was an astonishing discovery: Leonard van der Kuijp, Professor of Tibetan and Himalayan Studies at Harvard, had been able to reproduce this rare Tibetan text from an archive in Beijing. Coming across the story of the life of this extraordinary woman was like finding a treasure that had remained hidden for centuries. It was a fascinating narrative – vibrant and

unexpectedly human – and one that had become the basis for innumerable other stories, genealogical accounts, myths and rituals.

Tantalisingly, the manuscript was incomplete – the final pages were missing. It was in attempting to reconstruct details of Choky Dronma's life, her mysterious and untimely death at the age of 33 in a remote and holy area of south-eastern Tibet, and her disciples' search for her reincarnation that was to lead me not only across Tibet but also amazingly close to home: to a treasure-trove of rare Tibetan manuscripts in the University Library in Cambridge and the British Library in London.

The tale unfolds

With funding from the Arts and Humanities Research Council (AHRC), and under the guidance of Professor Caroline Humphrey in the Mongolia and Inner Asia Studies Unit (MIASU) of the Department of Social Anthropology, my adventure began by travelling the Tibetan landscapes with the text in hand, looking for her 'places' and her relics, including her long-lost skull. I found the ruins of the palace where she was born and the palace where she lived as a married woman, met the monks who



Legacy of a princess

In my research I discovered that Chokyi Dronma's relics, stories and images still have a great significance for the Tibetans, who are currently reviving her tradition, assembling all that has survived the ravages of the Cultural Revolution. I encountered her legacy among begging nuns who have managed to restore their nunnery, among the monks who looked for her images to re-paint the walls of their monastery, and among lay and monastic communities who have been trying to reassemble the texts and restore the sacred dances of her tradition. I saw her in the excited eyes of monks and nuns, but also nomads and farmers, holding in their hands copies of her biography, which has now been returned to Tibet to be made available for the people and the monasteries that currently embody the Dorje Phagmo's tradition.

I discovered that the incarnations of Dorje Phagmo have played important roles over the centuries for the religious and political leaders of their time: the Karmapa, the Dalai Lama and currently the Chinese administration. Several times I met the current Dorje Phagmo, now 70 years old; as one of the leading religious figures, she plays an important political, if largely symbolic, role in the new administration. When the Chinese authorities allowed the revival of religion in Tibet after the Cultural Revolution, she was able to use her influence to help in the revival of Buddhism and the reconstruction of the monastic system.

Pieces of the puzzle

Although my research was built around the translation of Chokyi Dronma's biography, missing pieces of the puzzle have also come to light from documents collected by the Younghusband Expedition, which passed in the vicinity of Samding on its way to Lhasa in 1904. The equivalent of over 200 mule-loads of documents was transported to England, originally to Cambridge University Library and the British Museum among others. Investigating these documents has been an AHRC-funded research project in its own right led by Dr Stephen Hugh-Jones at MIASU: the Tibetan-Mongolian Rare Books and Manuscripts project. These hitherto unresearched documents held histories that have helped complete details of Chokyi Dronma's life and times, and have brought to light some of the early Tibetan prints produced in her homeland.

A living tradition

Through this research project I sought to bring alive the image of this ancient princess and enrich the meaning that she has for the living tradition in Tibet, but also for wider audiences across cultures.

The research has uncovered more than a history; it has shown the importance of reincarnation in Tibetan society and religion, the role of biographies in establishing a lineage, the necessity for religious teachers to navigate complex networks of political and financial patronage, the cultural and social innovation linked to the revival of ancient Buddhist civilisations, and the role of women in Buddhism. And the story continues to unfold. We might speculate as to why the final pages of the manuscript were missing: were they unintentionally lost at some point over the centuries or were they deliberately removed, perhaps to conceal awkward details of her death? One day the closing chapter may yet be known of the woman who became a religious dynasty.

For more information, please contact the author Dr Hildegard Diemberger (hgmd@cam.ac.uk) at the Mongolia and Inner Asia Studies Unit, Department of Social Anthropology. *When a Woman Becomes a Religious Dynasty: The Samding Dorje Phagmo of Tibet* is published by Columbia University Press.



Dr Hildegard Diemberger

'From time to time anthropologists unearth surprises that would rank on anyone's register as 'discovery'. At the centre of this fascinating account is just such a discovery ...'

Dr Diemberger has made her own translation of the biography the centre of this book, and it is absorbing reading. She brings it alive through the directness of her language.'

Professor Marilyn Strathern,
Department of Social Anthropology

$P(A|B)$

Living with uncertainty

Assessing the chance of something happening or not happening confronts us all the time. A new programme led by David Spiegelhalter, the Winton Professor of the Public Understanding of Risk, is helping improve people's understanding of the mathematics of risk.

We all have to live with not knowing what is going to happen (what will the climate be like in 2050, when will I die, will the stock market crash?), what is happening (what is the current number of unemployed, do I have a tumour?), and what has happened (how many people did Harold Shipman murder, what caused my child's illness?). We learn to deal with this pervasive uncertainty, but potential threats to our well-being understandably make us uncomfortable, particularly when the risks seem poorly understood or are imposed by others. In all this anxiety and even dread, the ability to carefully analyse risks in a formal way can be overlooked.

Different people react to risks in different ways; it isn't enough to lecture people on probability and statistics and expect them to suddenly become 'rational'. An important consideration for statisticians must therefore be to develop an understanding of the social basis for attitudes to risk and uncertainty, and to maintain a two-way communication with the general public, students, scientists, media and policy-makers. This is the premise for a new programme at the University of Cambridge that will seek to help individuals, institutions and government to understand the possible consequences of their decisions in risky situations. The Winton Programme for the Public Understanding of Risk is funded by a £3.3 million donation from The Winton

Charitable Foundation. Appropriately, since the theory of probability is the scientific language of uncertainty, the programme is based in the Statistical Laboratory in the Centre for Mathematical Sciences (CMS).

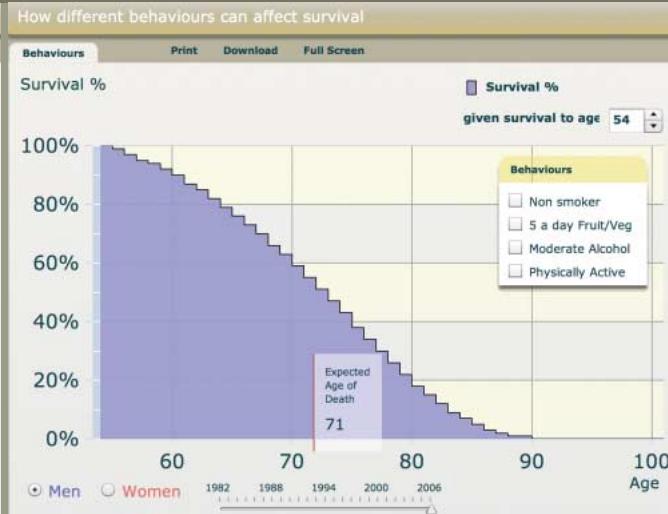
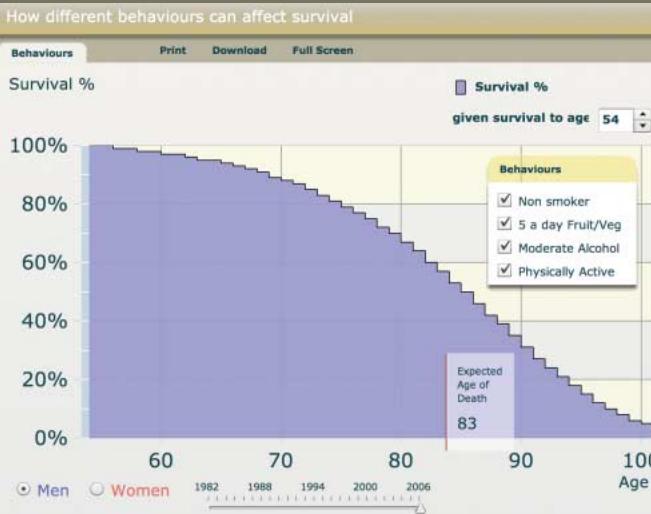
Understanding uncertainty

Uniquely, the Winton Programme is trying to service multiple audiences. The intention is to engage the public by introducing issues through stories, attractive graphics and entertaining animations, but then providing optional additional levels of mathematical analysis, ranging from arithmetic, through basic algebra and probability theory, to full technical explanations. Key to accomplishing this is the website www.understandinguncertainty.org, launched this May, which is intended to be not only interactive, authoritative and fun, but also an international resource for all aspects of the quantitative handling of uncertainty. The team behind the website includes web designers and animators Mike Pearson and Owen Smith, and social scientists Hauke Riesch and Arciris Garay-Arevalo.

Working with the media

The media clearly play a vital role in the perception of risk and how different risks might affect us in our everyday lives. In the past six months alone, we've been confronted with stories in newspapers or

Communicating risk



One part of the new initiative relates to the communication of risk. 'I went to my GP recently and we put my blood pressure, cholesterol, etc, into a risk equation and out popped the assessment that I had a 10% chance of a heart attack or stroke in the next 10 years,' said Professor Spiegelhalter. 'This was sobering news. We want to extend the usefulness of this kind of analysis to allow people to get to grips with the influence lifestyle may have on their future prospects.'

The team have created an animated graph relating lifestyle factors to current survival rates in the UK, using data collected by the Institute of Public Health in Cambridge through the EPIC-Norfolk study (www.srl.cam.ac.uk/epic). The study followed up 20,000 people in Norfolk to determine how different behaviours (smoking, drinking, diet and exercise) can affect survival. As an example, the survival prospects of a physically active, non-smoking 54-year-old who eats five fruit or vegetables a day and drinks only moderate amounts of alcohol are 12 years longer than someone of similar age who smokes, drinks over the recommended limits, does not exercise and has a poor diet. The risks are clear from the animated graphs. This simple animation allows people to 'play' with changing lifestyle in relation to age and is available on the programme website www.understandinguncertainty.org

on television about the risks of middle-class drinking, obesity, getting cancer from bacon sandwiches, and so on. Many stories suffer predictable but major distortions in the passage from scientific study, through press release, to presentation in the media. An important factor in achieving the necessary link between statistical analysis and the general public is therefore to establish a good working relationship with the media. The team's work has already been featured in a number of radio programmes and newspaper articles, not only on issues such as crime statistics or the obesity epidemic (BBC Radio 4), but also on more popular items such as the potential benefits of New Year's resolutions (*The Sun* newspaper).

Putting a risky future in perspective

The Winton Programme comes at a time when public, institutional and governmental awareness is highly receptive to issues of risk. Formal quantitative approaches to risk and uncertainty are of potentially great benefit both to individuals and to society, but it cannot be assumed that we can simply put a number on our uncertainty and thereby calculate the correct decision: it requires care and judgement to find the appropriate role for probabilistic reasoning in everyday life.



**Professor
David Spiegelhalter**

For more information, please contact the author Professor David Spiegelhalter (D.Spiegelhalter@statslab.cam.ac.uk) at the Statistical Laboratory (or visit www.understandinguncertainty.org). Professor Spiegelhalter is also Senior Scientist in the MRC Biostatistics Unit in Cambridge, which develops statistical methods to advance understanding of the cause, natural history and treatment of disease.

League tables and 'rare' events

As an example of the type of resource the programme website will host, the team have animated the entire history of the UK's National Lottery to illustrate the fact that spurious 'league tables' can be constructed from situations involving pure randomness, and that rankings of schools, sports teams, hospitals, or even universities can also be heavily influenced by chance.

Between February and November 2000 there was an extraordinary interval of 72 draws when ball number 17 never appeared as a winning (non-bonus) number in the National Lottery. At face value this is a very rare event (with a chance of around 1/12,500). But, because over 7000 balls have been drawn since the start of the lottery, the statistics show that this maximum gap is almost exactly what would be expected by chance alone. The animation provides a good demonstration that apparently very rare events are likely to happen when given enough opportunities. 'We've also animated results from Premier League football and shown that half the spread of points is due to chance alone,' said Professor Spiegelhalter. 'This goes down well in all the schools' talks we are doing.'

CamBridgeSens – a strategic initiative to bridge gaps across disciplines, departments and research cultures – launches this summer.

Bridging the sensor gap



World-leading research at the University of Cambridge is pushing the limits in sensor technology

We live in a world aided by sensors – devices that measure a physical quantity, convert the measurement to a signal, and interpret and act on the result to provide real-time information about the world around us. Their uses are as diverse as the science that goes into making them: monitoring environmental change and the state of our health; enhancing process control and product assessment in industry; providing security and safety information – in short, sensors affect how we live, work and make decisions. The value of the global sensor market has passed the £100 billion mark already and market projections predict enormous future growth.

World-leading research at the University of Cambridge is pushing the limits in sensor technology – ever smaller, cheaper, more sensitive and robust – reflecting the great strengths in sensor research in the physical sciences, engineering, mathematics, computer science and technology. But to allow the quantum leaps forward that many believe are possible, it is becoming crucial to connect the disciplines and bridge the gaps. This is the goal of CamBridgeSens, a new initiative sponsored by the Engineering and Physical Sciences Research Council (EPSRC).

'We aim to fundamentally change the way sensor research is conducted in Cambridge by creating an environment where researchers are able to explore their most adventurous and creative ideas. We also seek to connect the tremendous expertise and skills that exist here, to put us in a leading position to tackle even the most challenging problems in sensor research,' said Dr Clemens Kaminski, of the Department of Chemical Engineering, who leads the project with Professor Lisa Hall of the Institute of Biotechnology.

From sandpits to kindergartens

A key issue in bridging disciplines is to develop a common language, as Professor Hall explained: 'Because this initiative has at its heart a shared vision of traversing the boundaries of traditional sensor research and invoking unique interfaces between disciplines, a basis for communication needs to be achieved early enough to engage its partners and broaden the experience and appreciation of students.'

Underpinning this cross-disciplinary communication and collaboration will be a diverse group of 'Research Ambassadors', comprising leading researchers at Cambridge plus industrialists, all of whom are recognised world leaders in the sensor field. The programme will be managed 'from the bottom up' and major drivers will be future students engaging in sensor-related research. 'The quality of the studentship at Cambridge is a great asset,' said Dr Kaminski. 'By enabling young researchers to realise their ideas through 'sandpit' brainstorming events, research competitions and secondment opportunities (as well as through offers of real cash!), radically new approaches to sensor research will emerge.'

Through a 'kindergarten' programme, students will receive research experience in a variety of disciplines in their first or second year. Early-career researchers will be encouraged to undertake discipline-hopping secondments and industrial exchanges, supported by Research Ambassadors promoting interactions at the grass roots.

Breaking down barriers

The scale of CamBridgeSens is ambitious: under the steerage of Dr Mica Green, coordinator of the project, at least 50

research students will participate, and 20 Research Ambassadors have agreed to provide solid foundations for what is set to become a network of international excellence.

But the implications of the initiative stretch wide and have the potential to transform the training and research culture in Cambridge. 'By breaking down discipline barriers and creating identities between researchers with common research goals that transcend departmental affiliation,' said Professor Ian White, Chair of the School of Technology, 'Cambridge can play a powerful role in responding to challenging problems of the future.'



**Professor Lisa Hall
and Dr Clemens
Kaminski**



For more information about CamBridgeSens and how to participate, please visit www.sensors.cam.ac.uk/

New paths to drug discovery

A new Cambridge programme aims to meet the challenges of drug discovery by harnessing a spectrum of academic expertise.

A major scientific priority worldwide is the discovery and development of new drugs for treating human diseases. Our understanding of the molecular circuits controlling normal and diseased cells is now incredibly detailed. But with each major advance in fundamental science comes an abundance of potential targets for the next generation of medicines. How can these novel discoveries be translated smoothly to clinical benefits?

A new multidisciplinary initiative, the Cambridge Molecular Therapeutics Programme (CMTP), is pioneering methods for the discovery of drugs against new types of targets traditionally viewed as 'difficult-to-drug'. Equally important, these drugs are being used as chemical tools to find innovative ways for the successful clinical development of new medicines.

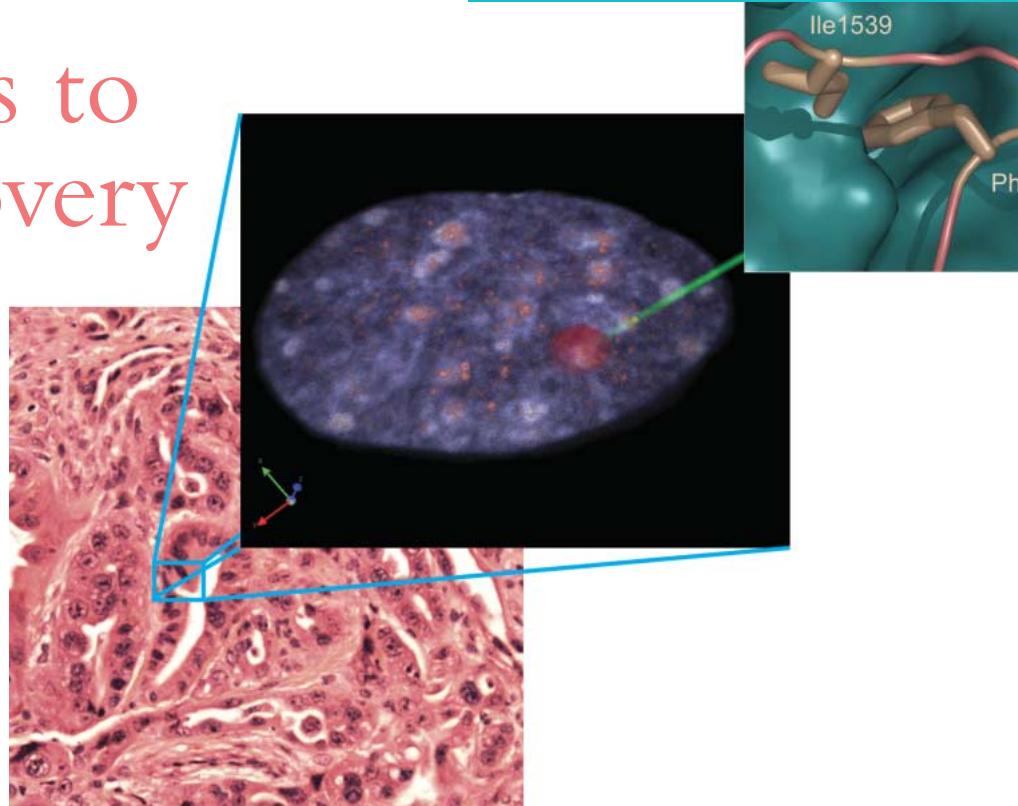
Considering the challenges

Drug discovery is expensive and protracted: the average cost of developing a new biotechnology product has been estimated to be \$1.2 billion (<http://csdd.tufts.edu>). 'One of the key challenges in this process is the limited repertoire of molecular targets that have been successfully "drugged"', explained Professor Ashok Venkitaraman, at the Department of Oncology and the Hutchison/MRC Research Centre. 'Despite the large number of molecular targets now implicated in human diseases, perhaps around 95% of new drugs are being made against fewer than 5% of the potential targets.'

To make matters worse, many new drugs are ineffective during early clinical tests in patients. Often this is the result of gaps in our understanding of their biological effects on cells and tissues, as well as the difficulty in identifying those patients who are most likely to benefit from the new treatments.

Exploring new paths

The CMTP, funded by the Medical Research Council (MRC), the Wellcome



Trust and the European Union, brings together researchers from across the University to address these challenges in relation to cancer and infectious diseases. Jointly directed by Professor Venkitaraman and Professor Sir Tom Blundell (Department of Biochemistry and Chair of the School of Biological Sciences), the initiative entails close cooperation with colleagues in the Department of Chemistry, including Professor Chris Abell, Professor Shankar Balasubramanian and Dr David Spring, as well as Professor Mike Payne at the Cavendish Laboratory. Each team brings a unique yet complementary set of skills to the programme.

'One objective is to develop innovative methods to discover drugs against novel or difficult targets, for which we have established several approaches in-house or with industrial partners,' said Professor Venkitaraman. 'As one important example of our efforts, small fragments of drug molecules are being soaked into crystals of the target to identify the site and nature of the binding interaction, and this information is being used to design and synthesise new types of inhibitors,' explained Professor Blundell. Professor Venkitaraman added: 'Other work in the CMTP combines chemistry and physics with functional genomics, fluorescence imaging and molecular cell biology to derive unique insights into human physiology and pathology. Through this we hope to guide the better design of clinical trials to test new drugs and to identify 'biomarkers' that help to distinguish patients who will benefit from the treatments.'

A new research paradigm

'The considerable strengths of Cambridge science in the physical, chemical and biomedical disciplines haven't previously been harnessed in this way to underpin a unique interdisciplinary collaboration for drug discovery,' said Professor Blundell. With its goal-oriented and milestone-driven organisation, the CMTP is offering a new and collaborative model for pharmaceutical research in an academic setting, smoothing the path from drug discovery to the clinic.



Professor Ashok Venkitaraman (left) and Professor Sir Tom Blundell

For more information about the Cambridge Molecular Therapeutics Programme, please visit www.hutchison-mrc.cam.ac.uk/cmtp/

Cosmopolitan cities of Eurasia

Research on the changing face of Eurasian cities – formerly famous for cosmopolitanism and now crossroads of migration – hopes to provide an understanding of their new social make-up.

Migration flows in the past 15 years have greatly altered the character of many cities of Eurasia. Research in the Department of Social Anthropology led by Professor Caroline Humphrey is comparing the changing social dynamics of three cities famed for their cosmopolitanism: the two great ports of the Black Sea – Odessa and Istanbul – and the trading and religious centre Bukhara in Uzbekistan. All three were extolled for their harmonious spirit and diversity during Tsarist/Soviet and Ottoman times. Now, most people of the previously large minority communities have emigrated: Jews to Israel or the USA; and Greeks, Armenians, Germans, Romanians, Russians and Tatars to their various homelands. What is the impact – in particular the cultural impact – of these sporadic, yet repeated, travels across the Black Sea?

Surging currents

The established patterns of multi-ethnic interaction in Istanbul, Odessa and Bukhara have been replaced by a new edginess. Incomers from rural areas have taken up the vacated places: villagers from Anatolia have moved into Istanbul, Ukrainians and other Slavs into Odessa, and rural Uzbeks into Bukhara. These migrations are happening at the same time that the cities find themselves in states that are stridently more nationalistic than they were in previous decades.

Seen en masse, Odessa and Bukhara look a good deal less ethnically and religiously diverse than they did. But on a small scale, a new group of global migrants is appearing: Chinese, Afghans, Vietnamese and Africans, mostly arriving to trade. And now, just as Turkish workers moved to Europe in the 1980s, there is also considerable out-migration of Uzbeks and Ukrainians from Bukhara and Odessa to international destinations for work. Indeed, Odessa has become something of a funnel-city, channelling mobile people (refugees, prostitutes,

domestic-workers, builders, shuttle-traders) from all over the former-USSR through Istanbul and other Black Sea ports to Europe and elsewhere.

The cities are thus becoming hosts to new kinds of 'trans-locality', set up not only by migration but also by tourism and the openings for the imagination offered by the internet. Yet there remain traces and images from former times. The research team has coined the term 'post-cosmopolitan' to characterise this many-stranded kind of urban sensibility. The project is exploring these three cities not so much to contrast them (although they are of course very different) but to point to common processes that seem to be occurring in many cities across Europe and Asia in the 21st century.

Residues and memories

As a start, it was necessary to study critically the conventional idea of cosmopolitan harmony, because it was often imposed by the state. The research team – Professor Humphrey and Dr Vera Skvirskaja in Odessa and Bukhara, and Dr Yael Navaro-Yashin in Istanbul – is documenting the narratives, recollections and practices of the real cosmopolitan relations that existed when people were forced to live together. People accepted, took a practical interest in, and often warmly respected other ways of life, but at the same time they upheld strict and nuanced boundaries between 'us' and 'them'. With certain groups it was permissible to take tea but not to eat together; with others one could attend a religious rite but in no circumstances marry.

Writers, architects, musicians, dressmakers, chefs, sailors, and all who were in touch with the magic of other cultures, were the vectors of cosmopolitan impulses. Dense urban interactions gave rise to idiosyncratic city-specific ways of speaking – 'languages' that were in fact mixtures of several languages – and the researchers were



often told that people's loyalty was to the city rather than to the state. These more or less cordial, but always limited, relations were robust. The ideal of urban civility persisted, even through revolution, state-inspired pogroms, and the influx of evacuees during World War II.

New social configurations

Today in Bukhara and Odessa those dense neighbourly relations have been replaced by more inward-looking and xenophobic attitudes. Many vignettes of city life confirm this. In the urban courtyards, where apartments are now privatised, strangers are often no longer welcome. Citizens have turned to the idea of 'tolerance', which pays lip-service



PROFESSOR CAROLINE HUMPHREY (BOTH IMAGES)



Above: Courtyards in Odessa were famous for their multi-ethnic conviviality; now, barriers such as the corrugated iron structure seen to the left are dividing up these spaces

Left: Placard celebrating the diversity of Odessa, 'Ba! We know all these people...'

diasporas across the world. There are over 10 times as many Bukharan Jews in Queens, New York, as in Bukhara itself. Communicating with the home city by websites, travel agencies, marriage bureaux, charitable organisations and investments, the departed groups are increasingly influential in the home cities at a distance. The Greeks or Jews left behind, who are often elderly and bereft, typically say they feel like marginal outposts of world communities in their own home cities, especially with the consolidation of Islam in Bukhara and Istanbul, and Orthodox Christianity in Odessa.

Nevertheless, there are lively strands that cross this picture of retrenchment. Many traders with international links have made their fortune. Even a few Gypsies, who are largely excluded from mainstream business, have become rich, building palatial houses and burying their dead in marble mausoleums in one of the old Jewish cemeteries. Commercial links between the two Black Sea cities have transformed parts of old Istanbul, where Russian sometimes serves as a *lingua franca*.

Just as in the 1920s, when Russian women émigrés were said to have 'wrought more destruction [of Turkish morals]...than Russian armies in centuries', today Slav women, including prostitutes, can be represented as agents of modernisation, especially of gender relations among rural migrants in Turkish cities. Meanwhile, Turkish men going the other way, said to be excellent and sober husbands, have set up flourishing businesses in Odessa.

Living historically

This research is only beginning. One of the themes to be explored is history, materiality and affect in the city. Diverse previous communities have left traces in the form of religious buildings, cemeteries and particular architectures. In Istanbul, neighbourhoods previously inhabited by Greeks, Jews and Armenians have abandoned churches and houses marked by the Star of David or with the names of former owners. In studying such complex urban spaces as lived and remembered phenomena, the research explores a new idea of 'vertical' cosmopolitanism – that which is embedded in the layered historical remains of the city.

For more information, please contact the author Professor Caroline Humphrey (ch10001@cam.ac.uk) at the Department of Social Anthropology. The Black Sea Currents project is funded by the Arts and Humanities Research Council (AHRC) as part of the 'Diasporas, Migration and Identities' trans-disciplinary programme.



Professor Caroline Humphrey

to earlier traditions, but in fact requires only that strangers be tolerated – in other words ignored, not beaten up. Even tolerance is under strain. The vast container market of southern Ukraine called '7th Kilometre' has been sited outside Odessa, and the Afghan, Vietnamese and other traders are afraid to travel there except in convoy for fear of attacks. Sailors describe how merchant ships travelling the seas from Odessa, formerly transmitters of cosmopolitanism, are now rigidly divided – the sailors of different ranks and ethnicity barely talk to one another.

Meanwhile, the few people left of the old minority communities in the cities are experiencing a huge shift in gravity. Out-migration has created populous new

How do plants tell the time and the passing of the seasons? Plant scientists are enlisting the help of engineers in their quest to uncover the rhythms of circadian clocks.



Clockwork plants

Ever since the French scientist Jean-Jacques d'Ortous de Marian discovered in the 1700s that patterns of leaf movement follow a 24-hour clock, our understanding has been growing of the in-built clocks that plants and animals live by. 'Circadian' clocks are important for living organisms to maintain the rhythms of life and have evolved independently at least four times: in blue-green algae, fungi, animals and plants. Desynchronisation of the clock with the environment has adverse effects – all too familiar for those who have experienced the unpleasant feelings of disorientation during 'jet lag', where the crossing of time zones disrupts the functioning of the circadian system.

Plants, which are literally rooted to the spot, use their circadian clocks to help them adapt to the night/day cycles of light and temperature caused by the rotation of the Earth, whether it is preparing for day-time photosynthesis or preventing night-time water loss. Seasonal events like fruiting and leaf drop are also governed by the clock. Increasing our understanding of the molecular mechanisms at work therefore has wide implications: from the possibility of selective crop breeding, through increasing ecosystem productivity, to control of atmospheric CO₂.

Dr Alex Webb and colleagues Drs Antony Dodd and Michael Gardner in the Department of Plant Sciences have been working to understand the intricate processes of the daily clocks of plants. Recent findings have taken a surprising turn, one that is benefiting from the application of engineering principles

through a collaborative project with Dr Jorge Gonçalves in the Department of Engineering. The research, funded principally by the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC), is combining engineering control theory and plant cell biology, with the result that novel tools are being developed to understand oscillating biological systems.

Regulating rhythms

A circadian clock comprising 10–20 genes that form interconnecting feedback loops of gene expression is present in every cell of the plant. Initiated by changes in light and temperature, these linked loops of gene expression control a huge amount of plant biology; plants grow rhythmically, with rhythms of metabolism and even rhythms of photosynthesis, and a third of all plant genes are switched on and off within a 24-hour cycle.

How can the activity of so few genes have such a pervasive effect on the biology of plants? It seems that the level of calcium, a key regulator of cellular events in all organisms, is crucial. In plant cells, the concentration goes up and down with a 24-hour rhythm governed by the plant circadian clock.

Dr Webb and colleagues have discovered that what causes the rhythms of calcium to change is a molecule called cyclic ADP ribose (cADPR). By studying Thale Cress (*Arabidopsis thaliana*), the researchers found that the concentration of cADPR is regulated by the circadian

clock genes and that fluctuations in calcium levels are caused by cADPR binding to protein channels in the internal membranes of plant cells, permitting calcium to enter the living part of the cell.

Loops within loops

The next discovery was a surprise: not only is cADPR regulated by the circadian genes but many circadian-regulated genes are themselves regulated by cADPR. This led to the intriguing hypothesis that the clock genes cause 24-hour oscillations of both cADPR and calcium, which in turn regulate the level of activity of the clock genes as part of a new loop in the plant circadian clock – a sort of loop within a loop. The problem was how to test this hypothesis.

This is where the skills of the engineers allowed an advance that could not be achieved using biological techniques alone. By creating mathematical simulations of how a plant's circadian system might behave, they were able to compare these simulations with the behaviours of genetically modified plants with altered cADPR levels. The results, published in December in *Science* magazine, demonstrate the existence of this feedback loop.

Running fast and slow

One intriguing feature of these findings is that by interfering with cADPR signalling the plant clock might be forced to run faster or slower. Dr Webb and Professor Andrew Millar at the University of Edinburgh found that mutant laboratory



Circadian control of leaflet movements in *Mimosa pudica*

strains of plants with clocks that run fast or slow grow to half the size of neighbours with a correctly functioning clock. Remarkably, when put in artificial light/dark cycles that matched the 'expectations' of the mutant clocks, the mutant plants grew better than normal healthy plants. It seems therefore that matching a clock to the local day-length conditions could have beneficial effects on plant growth.

By making a plant clock run faster for short daylight hours or slower for long daylight hours, interesting opportunities might arise in crop development for bioenergy and agricultural output. This might in fact have been the accidental outcome of the selective breeding of barley by farmers thousands of years ago, when they began moving the crop further northwards, where summer day-length is longer. Working with colleagues at the National Institute of Agricultural Botany in Cambridge, Dr Webb is investigating the circadian clock of different barley varieties to see if this might be true.

New mathematical tools

Meanwhile, the collaboration between the engineers and plant biologists is continuing. One spin-off has been the development of new types of mathematical tools to understand complex systems.

The tools used by control theory engineers have been very successful at designing a large number of technological systems, from the simple cruise control required to maintain the speed of a car, to more complex controls that allow



**Dr Alex Webb
(left) and
Dr Jorge
Gonçalves**

inherently unstable aeroplanes to fly. When looking at biology, however, it's clear that new mathematical tools are needed to analyse biological systems. These systems are highly complex, dynamic in space and time, have many components that are often used to perform multiple tasks, often involve feedback with clear non-linear behaviours, and, perhaps most challenging of all, biological data are typically expensive, lengthy to obtain and noisy. To deal with the complexities of biological systems, engineers Dr Gonçalves and Dr Guy Saint-Bart are developing new theoretic mathematical approaches to study such complex non-linear systems.

As collaborations between biologists, engineers and mathematicians become more common, it seems that the world of biology is changing. And Engineering Departments too are changing: increasingly, engineers are turning their expertise towards biological systems such as plant growth, gene expression, cancer, cognition and the beating of the heart.

For more information, please contact the authors Dr Alex Webb (aarw2@cam.ac.uk) at the Department of Plant Sciences or Dr Jorge Gonçalves (jmg77@cam.ac.uk) at the Department of Engineering. This research was published in *Science* (2007) 318, 1789–1792.

Charlie Chaplin in *Modern Times* (1936)

Why have writers been so fascinated by cinema? What role might this 19th-century invention play in the digital age?

Celebrating cinema, from 1895 to the digital age

As applications of digital technology – YouTube, Facebook, Second Life, chatrooms, multiplayer gaming – proliferate all around us, it would be easy to forget that film was once the newest of new media. In the 30 years or so after its invention in 1895, film transformed habits of thought and perception as radically as the internet and the mobile phone have done during the past decade. Contemporary writers, from James Joyce and Virginia Woolf to Grahame Greene, Samuel Beckett, and beyond, observed with passionate interest cinema's emergence as the 20th-century's dominant cultural form. Professor David Trotter, of the Faculty of English, has been researching this phenomenon, asking: What did writers see in cinema? Does their response tell us anything about the medium's enduring capabilities? Will those capabilities complement, contest, or lose out to newer media and newer art-forms?

Machines for seeing

Just why did Joyce, and so many other writers, take an interest in cinema? It

seems that they liked everything about it that was mechanical. A machine had captured the images; a machine would project them in front of an audience. In cinema, unlike theatre, performer and audience never coincide; for one to be present, the other must be absent. This gap in time and space permits reflection. The screen is a mirror. The images in which you find your desires and anxieties reflected allow you to reflect on yourself. And these images stir thought, because the camera notices what the human observer would overlook. As the poet Marianne Moore put it, 'like the lie detector of the criminal court,' film 'reveals agitation which the eye fails to see.'

The film camera, a machine for seeing, seemed at once to enact and to invite enquiry into ways of being human for which there was as yet no other adequate definition. Early 20th-century cinema frequently took as its subject a person's relationship not to another person, or to god, nature, society or nation, but to a tool, instrument, or technology. This is nowhere more

apparent than when Charlie Chaplin, hotly pursued, disguises himself as a lampstand or a fairground automaton. Even after the pursuit has moved on, he lingers inside his contraption. He is fascinated by that mechanism in mechanical behaviour which somehow has more life to it than non-mechanical behaviour. When a machine grabs *him*, as one does in *Modern Times* (1936), well, that has its fascinations, too.

Representing technique

Cinema reminds us that the history of humanity has always been the history of technology, from the stone axe to the mobile phone. We are, for better or worse, what our machines (our tools) have enabled us to do. There is always, inside our most intimate sense of ourselves, a *technique*: the knowledge we have acquired, in bits and pieces, often painfully, about how to 'handle' life. During its golden age, from the 1920s to the 1950s, Hollywood specialised in representing technique. Fred Astaire and Ginger Rogers enthralled millions because they knew how to dance. And knowing how to dance meant knowing how to live.

Hollywood 'on the line'

If cinema has tended to embrace technique, it has often been wary of rival technologies. The movies, for example, are deeply suspicious of telephony. Much better to let the phone ring, if you're in a Hollywood film (but no-one ever does). Answer it, and your life is instantly 'on the line'. For the call, in these movies, is never not an intrusion. It ruthlessly finds you out in your most private being, with bad news, or threats, or abuse, or the sort of invitation you cannot refuse.

Cinema always wants to describe what's at stake in these transactions which so unceremoniously abolish physical and moral distance. It does so by the power of the visual image. In film after film, the apparatus itself looms large in the frame, grotesquely brooding until called into action, and then once in action, clamped like an armature or strange protuberance to the talking head. These images reinstate the surrounding world in its material presence: all that we no longer notice when absorbed in the sounds of telecommunication. Even at its most flippant, or programmatically shocking, cinema instructs us about our technological habits. When one of Freddy Krueger's victims makes the mistake of answering the phone in *A Nightmare on Elm Street* (1984), the receiver she holds to her face metamorphoses obscenely into his mouth and tongue.

And now?

It's a common assumption today that the old medium of cinema will sooner or later be rendered obsolete by, or merge into, web-based media applications such as pod-casting and video-streaming. These offer what film cannot: the potential for interactivity and real-time communication at a distance. And yet, as its long campaign against telephony so vividly demonstrates, cinema can offer an entertaining and instructive commentary on the principles which define these new media, and the habits to which they give rise. This is where the time and space it offers for reflection come in. *The Matrix* (1999) set new standards for digitalised special effects; it exists both as a movie and as a computer game. But by vividly establishing the telephone as the portal between real and virtual worlds, *The Matrix* invites us to ask just how much interactivity and communication at a distance we really want.

Hollywood films constitute a vast archive – rarely if ever examined from this point of view – of attitudes to and fantasies about the technical self: the self which has been immersed in technique, in technology, and so has become its own tool or instrument. Cinema's response to the new media has only just started. The digital age awaits its Charlie Chaplin.



ROBIN GRIERSON

Establishing a research and teaching culture in screen media in Cambridge

Screen media – from film, through television and video, to the new digital arts – are currently the focus of a rich and rapidly evolving array of research initiatives in the arts, humanities and social sciences in Cambridge. Reflecting this, an interdisciplinary MPhil in Screen Media and Cultures was launched last year with the participation of departments throughout the University. The MPhil recruits both nationally and internationally, and has become the focus for individual and collaborative research into the history and theory of screen media. 'The opportunity has never been greater to develop and understand the historical and theoretical relationship between the moving image and the cultures which gave rise to it,' said Professor David Trotter, who founded the MPhil, 'and we hope that the course at Cambridge will in time make an important contribution to that process.'

For more information, please visit www.screenmedia.group.cam.ac.uk



**Professor
David Trotter**

For more information, please contact the author Professor David Trotter (wdt21@cam.ac.uk) at the Faculty of English.

As more people become city-dwellers, can we design cities to be more sustainable?

Designing sustainable cities of the future

Today, half of the world's population live in cities, and estimates by the United Nations suggest that by 2030 this will have risen to two-thirds. As the world population increases from 6 to 8 billion at current predictions, rural towns will become cities and cities will grow larger. In developed countries, as many as 83% of the population will become city-dwellers.

Cities have expanded over time to meet the economic growth and lifestyle aspirations of those who live in them. But they have grown at the expense of increasing rates of resource consumption and increasing waste production and carbon emissions. Can urban planners design cities of the future that will be sustainable: cities with good air and water quality, where transportation systems are optimised, and energy consumption and carbon emissions are reduced? Understanding how to accomplish this is the aim of a new four-year project, 'ReVISIONS', led by the University of Cambridge's Department of Architecture.

A multidisciplinary consortium

With funding of £3.85 million awarded by the Engineering and Physical Sciences Research Council (EPSRC) as part of their Sustainable Urban Environment programme, the project brings together the Universities of Cambridge, Aberystwyth, Exeter, Leeds, Newcastle and Surrey. Each institution contributes expertise in different areas to the multidisciplinary project, from energy generation and supply, through water and waste management, to assessments of demography, economics, health and sustainability.

Cambridge's role will be to coordinate the project and design the options and modelling framework for land use, buildings and transport. Because the research is constructed from the outset with the purpose of having direct value for public and private decision-makers, key partnerships have been formed with regional planning authorities and private companies, with the East of England Development Agency (EEDA) being one of the leading partners.

25 years. Computer models have been used to assess combinations of land use and modes of transport, asking how changes in the planning of suburbs might affect how people travel, their cost of living and the damage to the environment. The results are being used to draw up policy advice for central and local government, as well as design guidelines for planners, house builders and environmentalists alike.

Towards sustainable living

Important considerations in planning a sustainable city include how best to plan its infrastructure for coordinating transport, water, waste and energy, and these will form core research questions in the ReVISIONS project. Although the research focuses on London, the Greater South East and the North East of England, the project also looks beyond the UK, to Beijing, São Paulo and Los Angeles city regions, providing a valuable international perspective. As the world moves towards greater urbanisation, the team's goal is to deliver innovative and practical guidelines on how best to plan cities for sustainable and economic growth, as well as for improved quality of life for the billions of people who live in them.

From SOLUTIONS to ReVISIONS

The ReVISIONS project builds on expertise developed through 'SOLUTIONS', a four-year EPSRC-funded project in the Department of Architecture that reaches completion in September 2008. Here, the focus has been on designing suburbs of the future – improving the quality of life for people who live in the outer fringes of cities.

SOLUTIONS has focused on four UK cities, including Cambridge, which are experiencing high growth pressures in their suburbs. Like ReVISIONS, the planning horizon for testing designs is



**Professor
Marcial Echenique**

For more information, please contact the author Professor Marcial Echenique (me15@cam.ac.uk) or the Project Manager Dr Anthony Hargreaves (ajh91@cam.ac.uk) at the Department of Architecture.

SOLUTIONS: Sustainability of Land Use and Transport in Outer Neighbourhoods

ReVISIONS: Regional Visions of Integrated Sustainable Infrastructure Optimised for Neighbourhoods

Professor Nicola Clayton

Nicky Clayton, Professor of Comparative Cognition in the Department of Experimental Psychology, has thrown the doors wide open on animal cognition. Where once the idea would have been dismissed that animals can re-experience the past and plan for the future, her imaginative studies have shown this inherent cleverness in crows.

Nicky Clayton has always been fascinated by birds – by their glamour and elegance, their movement and rituals, their melodies and labours. This abiding passion has taken her from studying birdsong in zebra finches to observing complex feats of cognition in members of the corvid (crow) family, which includes scrub-jays, British jays, ravens and crows. Moving from the University of California Davis to Cambridge's Department of Experimental Psychology in 2000 with her colony of scrub-jays, she embarked on a series of experiments with colleague Professor Tony Dickinson that was to break new ground in comparative cognition. Their inventive experiments have shown that birds hide (or cache) food, remember where to recover it from at a later date, and even steal it from each other. Not only this, but by remembering past events (such as whether or not they would find breakfast in a certain room in the morning), the birds could take action for their future (by moving breakfast into the empty room the night before).

The widely held view had been that animals can learn things through experience but not through memory; this ability to mentally travel back through time – so-called episodic memory – was thought to be something unique to the human race. For the first time ever, these experiments showed that humans are not alone in being able to remember a past experience in terms of what happened, where and when.

Nicky Clayton's research has already branched out to cognitive studies comparing corvids with great apes through a collaborative project with her husband, Dr Nathan Emery (Queen Mary, University of London). She is now also embarking on similar studies in young children with Dr Jim Russell in the

Department of Experimental Psychology. These incredibly productive collaborations hold great promise for our future understanding of the workings of the brain in animals and humans.

What would others be surprised to learn about you?

A large part of my life is spent dancing – ballet, jazz, and particularly Latin dance like salsa and tango. Of course birds dance too: I have a favourite video clip that I show my students of the dance of the Swallow-tailed Manakin – it's the avian equivalent of tango, and not surprisingly therefore they are found in Argentina! Two males perform a duet, a fabulous, showy double-act in which they display their beautiful plumage and synchronised movements. The males spend 90% of their time for nine months of the year dancing – a pretty intense avian dance school. This example encapsulates why I love dance: the elegance of movement, the colours, form, intensity and dedication – it strikes the core of my soul.

Who or what inspires you?

What inspires me is the curiosity and creativity of science, and the social and serendipitous meetings between people that lead on to discoveries. My academic hero is the late Bill Thorpe, Professor of Animal Ethology and founder of Cambridge's Sub-Department of Animal Behaviour. He was an incredibly wise man and in many ways ahead of his time: he suggested that because bird brains are structurally different from the classic mammalian structure people shouldn't assume that they are creatures of instinct. We now know of course that birds have quite impressive cognitive abilities.

Have you ever had a Eureka moment?

I suppose when Tony Dickinson and I first met – at the International Comparative Psychology meeting in Montreal in 1996 – and he said animals don't need episodic memory. That got us talking and we began asking questions in a way that nobody else had been doing before. Out of that developed a wonderfully fruitful collaboration, with the result that four years later I moved here and we have been collaborating ever since.

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

Lord Krebs of Wytham, whom I worked with in Oxford, always emphasised the importance of balance in your life. His maxim was 'healthy minds need healthy bodies'.

PHILIP MYNOTT



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

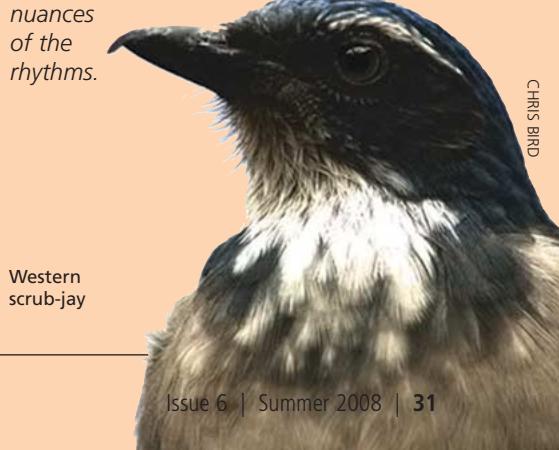
I'd like to be able to dance flamenco. And I'd like to be reincarnated as a scrub-jay – imagine what it must be like to experience being part of this clever family of birds and find out what they really are thinking!

What motivates you to go to work each day?

That's really easy: I love what I do. I love my days spent in research, in teaching undergraduates and graduates, in running a wonderfully supportive family-style lab, and last but by no means least, these long-term collaborations with my two best friends – Nathan, who is my husband and soulmate, and dear Tony. And I love releasing steam by dancing tango and salsa.

What is your favourite research tool?

My eyes and ears. For so much of the work I do what's essential is detailed observation – looking and listening. It's also important for dancing – being a good observer and a good listener helps you to copy the nuances of the rhythms.



Western scrub-jay

CHRIS BIRD



The mission of the Medical Research Council (MRC) is to support the best research and training to improve human health. With a portfolio that encompasses MRC Units and Institutes, universities and hospitals, the MRC funds research that ranges from fundamental molecular biology through animal models and clinical research to population studies.

Much of what the MRC does is in conjunction with the Health Departments in England and the devolved administrations, the National Health Service, other research councils, industry and charities. This research has led to some of the most significant discoveries in medical science and has benefited millions of people in the UK and around the world. But the benefits go beyond improvements in health care. A study commissioned by the University of Cambridge and others shows that the University's impact on the economy is considerable. MRC-supported research in life sciences is a substantial contributor to this.

- Each year, the MRC spends more than £60 million supporting the eight MRC research establishments in Cambridge (comprising over 1000 scientists and students), many of which work in partnership with research groups in the University.
- The planned building of the new MRC Laboratory of Molecular Biology (LMB) will be the flagship of the newly expanded Cambridge Biomedical Campus and includes space for research groups from the Clinical School.
- Neuroscience, cancer and metabolic science are important research areas in Cambridge: the MRC recently awarded £2 million to Professor Carol Brayne to study healthy life and cognition across generations and £1 million to Professor Ashok Venkitaraman towards the new Cambridge Molecular Therapeutics Programme (see page 23 of this issue). Much of the research in the new Institute of Metabolic Science is funded by the MRC (see right-most panel).
- In the past two financial years alone, the MRC has awarded 58 grants and fellowships to the University worth over £40 million, including many for fundamental science such as the recent grant to Drs Helen Mott and Darerca Owen (see centre panel).

The MRC is now particularly keen to encourage ambitious longer term proposals (for up to five years), both from established researchers and from those new to the MRC. Following the recent settlement for the science budget, MRC funding is set to increase to £682 million a year by 2010, as part of the alignment with the National Institute for Health Research (NIHR) and other public sector funders. Through a single health research strategy, the MRC will be able to translate scientific findings into benefits for patients as quickly as possible, as well as continuing to attract international investment and fuel the ever-growing knowledge economy.

Details of the MRC Delivery Plan, new funding schemes and full information for applicants can be found at www.mrc.ac.uk

Hunting for hotspots in

Two biochemists have recently won an MRC grant to investigate potential targets in the treatment of cancer.

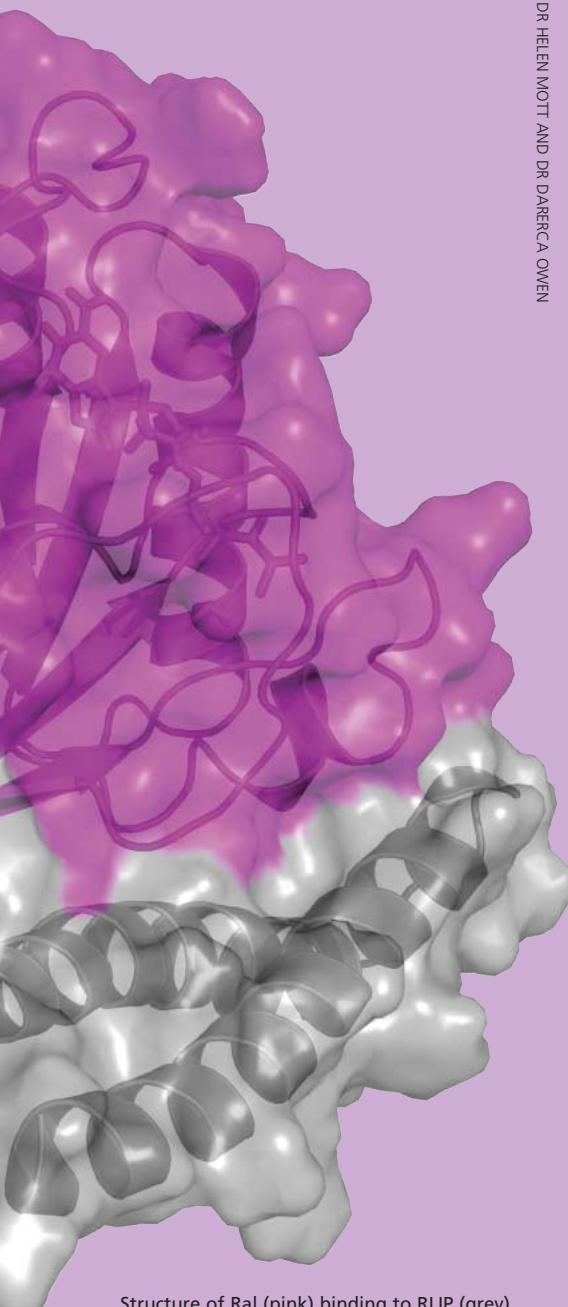
Drs Helen Mott and Darerca Owen in the Department of Biochemistry are studying a family of proteins known as RalA and RalB that have recently moved into the limelight as 'key offenders' in the progression of normal cells to cancerous cells.

Although discovered 20 years ago, comparatively little is known of the interactions of RalA and RalB with other proteins. 'Being awarded our first MRC Project Grant has meant that we can focus on the binding of RalB to a protein known as RLIP', said Dr Mott, who has previously been funded through both a Training Fellowship and a Career Development Award from the MRC. 'We're interested in how they bind together at the molecular level and which regions are particularly important for interaction – the 'hotspots' – as these are potential targets for drug design,' explained Dr Owen. 'If you can target the hotspots, you might be able to interrupt the interaction.'

With their strong track record in solving the structures of proteins using nuclear magnetic resonance technology and molecular biology expertise, Drs Mott and Owen plan to design mutants to inhibit binding and determine what effect this has on cell function. 'Because the signalling networks that govern a cell are enormous, it's really difficult to tease out how everything fits together,' explained Dr Mott. 'These types of studies are helping by homing in on a specific aspect at the molecular level: the mechanism of how one protein binds to another and with what effect.'

For more information, please contact Dr Helen Mott (hrm28@bioc.cam.ac.uk) or Dr Darerca Owen (do@bioc.cam.ac.uk) at the Department of Biochemistry.

protein interactions



Structure of Ral (pink) binding to RLIP (grey) solved by nuclear magnetic resonance spectroscopy



**Dr Darerca Owen
(left) and
Dr Helen Mott**

Translating research into healthy lives

MRC-supported initiatives on the Cambridge Biomedical Campus aim to combat health problems linked with obesity and lifestyle.

DR HELEN MOT AND DR DARERCA OWEN



Institute of Metabolic Science

Obesity, and its associated health problems, including type 2 diabetes, metabolic disorders and some cancers, has become one of the most pressing public health issues in the developed world. It is estimated that the number of premature deaths attributable to obesity is around 30,000 each year, costing the National Health Service an estimated £1 billion annually. Recently released statistics from the National Health Service (www.ic.nhs.uk) show that nearly a quarter of all adults and 16% of children in England are classified as obese and that the problem is escalating.

Responding to these challenges, two new developments on the Cambridge Biomedical Campus at Addenbrooke's Hospital will break new ground in translating medical research to patient care: the Institute of Metabolic Science (IMS), under the joint leadership of Professors Steve O'Rahilly and Nick Wareham, and the Centre for Public Health Research Excellence in Diet and Physical Activity, directed by Professor Wareham.

The IMS, which will be officially launched on 24 July 2008, is a tri-institutional partnership between the MRC, the University and the Cambridge University Hospitals NHS Foundation Trust. Its visionary strategy is to link research into the fundamental understanding of obesity and metabolic diseases directly to patient care through the three initiatives it houses: the MRC Epidemiology Unit; the University of Cambridge's cross-departmental Metabolic Research Laboratory (MRL), which includes the MRC Centre for Obesity and Related Metabolic Diseases; and the Clinical Care Centre for treating patients.

In January this year it was announced that the Institute of Public Health would

be one of five Centres of Excellence across the UK to tackle public health issues that have a significant impact on the health of the nation. The new Centre for Public Health Research will provide the evidence-base for public health interventions, with the aim of improving diet and physical activity across the population. Funding was provided under the umbrella of the UK Clinical Research Collaboration (UKCRC), a partnership of funders led by the Economic and Social Research Council (ESRC) and including the MRC, which together have invested £20 million over five years to establish the Centres of Excellence.

'These are interesting developments for Cambridge,' said Professor Wareham. 'They provide depth to a balanced approach to investigating the underlying causes of obesity and metabolic disorders, as well as simultaneously researching individual and population approaches to prevention.'



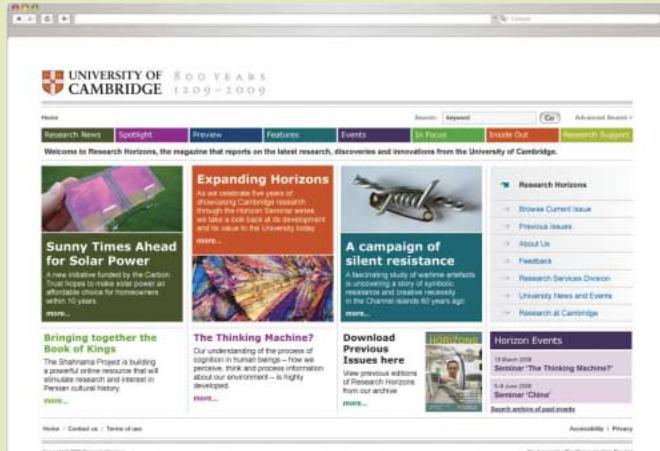
**Professor Nick
Wareham**

Please visit www.ims.cam.ac.uk for more information on the IMS, and www.iph.cam.ac.uk for more information on the Centre for Public Health Research Excellence in Diet and Physical Activity.

NEWS FROM RESEARCH SERVICES DIVISION

Research Horizons online!

An exciting new development for Research Horizons is under way.



The next issue of Research Horizons will mark two years of showcasing the excellence and breadth of research across the University of Cambridge: from arts and humanities to science and technology, we aim to inform our readership with the latest developments in all fields of research. Later this year, we will be launching an online version to accompany the print format. With regular updates, searchable articles, links to related content, seminars and multimedia, we hope that Research Horizons online will provide a wide audience with a valuable resource.

For further information, please email
Research.Horizons@rsd.cam.ac.uk

Connecting industry and academia through knowledge transfer

Forming a partnership with a company can help link academic skills and expertise with the needs of an industrial partner.

Funding is available for academics wishing to forge links with industry and companies seeking to benefit from high-calibre academic research. Two schemes – Knowledge Transfer Partnerships (KTPs), funded by the Technology Strategy Board (TSB), and Knowledge Partners East of England (KEEP 3), funded by the East of England Development Agency (EEDA) – provide joint funding between a sponsor and a company. The industry-academia partnership works together to select a graduate to embark on a specific project for 1–3 years (KTP) or 3–6 months (KEEP 3). Projects can be undertaken in a wide range of areas, including product design, manufacturing, technical innovation, business processes, IT, social sciences and commercial development.

'Schemes such as these bring great benefits, through knowledge transfer and development of commercial awareness,' explained Lisa Wears of RSD's Partnership Group and the University's KTP Manager. 'There is certainly room for growth of this type of funding at Cambridge and we would be pleased to help and advise academics and companies interested in these schemes.'

For more information on KTPs and KEEP, please contact
Lisa Wears (email: Iw337@rsd.cam.ac.uk;
Tel: +44 (0)1223 765442).

NEWS FROM CAMBRIDGE ENTERPRISE LTD

Good performance results, a re-launched website and plans for a new home: the foundations of a solid future for Cambridge Enterprise Ltd.

Cambridge Enterprise helps University of Cambridge inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful. To help achieve its goals of building strong relationships with University academics and being an attractive partner for industry and investors, the company is in the midst of an exciting period of evolution and dynamic change.

Performance metrics

Cambridge Enterprise marked its first birthday as a limited company in December 2007. During its first year, 60 licences and 95 consultancy contracts were finalised, 118 new inventions disclosed, 44 UK or US priority patent applications filed and the company assumed the management of a portfolio of 72 companies in which it holds equity. The turnover from technology and knowledge transfer was £6 million, of which £5.3 million (88%) was returned to the University's academics and departments.

Re-launch online

A new-look Cambridge Enterprise website (www.enterprise.cam.ac.uk) was launched in February, providing information to the University community and the commercial sector on the range of consultancy, technology transfer and seed fund services offered.



The Hauser Forum, designed by Wilkinson Eyre Architects, showing the Centre for Entrepreneurship to the right

Building the future

A new home for Cambridge Enterprise is planned at the University's growing science and technology campus on the West Cambridge site. In January it was announced that an £8 million gift to the University by the Hauser-Raspe Foundation, on behalf of entrepreneur and business angel Hermann Hauser and his wife Pamela Raspe, would create the Hauser Forum in West Cambridge. The Forum will comprise two landmark buildings, one of which – the Centre for Entrepreneurship – will become the new home of Cambridge Enterprise. It is intended to create a focal point for the promotion of entrepreneurship, with offices, incubation spaces and a seminar centre. 'This new building will provide a strong base for Cambridge Enterprise as it builds upon its success in commercialising the University's research,' said Professor Ian Leslie, Pro-Vice-Chancellor for Research.

For more information, please contact Cambridge Enterprise Ltd (email: enquiries@enterprise.cam.ac.uk;
Tel: +44 (0)1223 760330; www.enterprise.cam.ac.uk).

FORTHCOMING EVENTS: SAVE THE DATES!

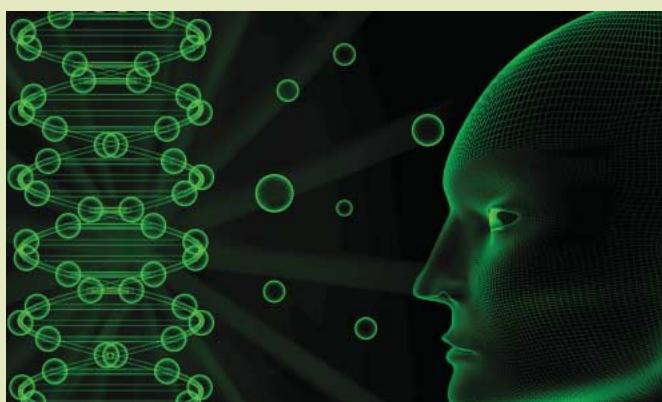


5–6 June 2008

Horizon Seminar 'China'

Buckingham House, New Hall, Cambridge

As the global spotlight falls firmly on China in 2008, we showcase the diversity and richness of China-related research and expertise at the University of Cambridge. This Horizon conference will highlight themes of culture, religion, education, literature and language, alongside business, technology, economy and the environment. The conference is supported by Cambridge Network (www.cambridgenetwork.co.uk). For more information, please visit www.rsd.cam.ac.uk/events/horizon or email horizon@rsd.cam.ac.uk



1 October 2008

Horizon Seminar 'Single Component Biology is Past; Bioengineering has Begun'

Centre for Mathematical Sciences, Cambridge

The huge influx of new ideas and principles being brought into biological research by mathematicians, physicists and engineers means we are no longer restricted to reductively studying biology. This Horizon Seminar will demonstrate how bioengineering exploits these new developments, providing technical solutions to current and emerging health and environmental concerns. For more information, please visit www.rsd.cam.ac.uk/events/horizon or email horizon@rsd.cam.ac.uk

9 December 2008

Horizon Seminar 'Materials'

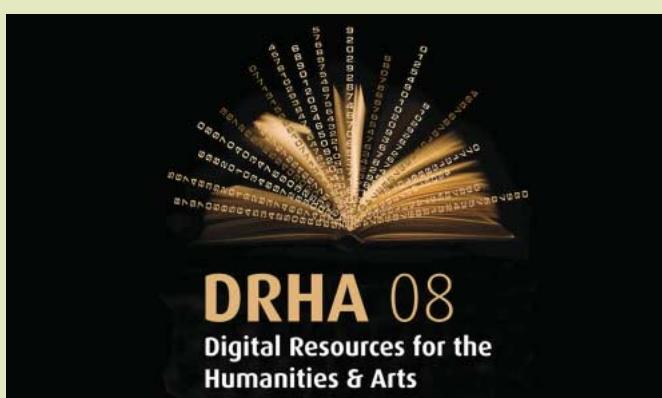
Further details to follow.

1 April 2009

Horizon Seminar 'Reproductive Health'

Further details to follow.

Horizon Seminars are organised by Research Services Division.



14–17 September 2008

'Digital Resources for the Humanities and Arts (DRHA) 2008'

West Road Concert Hall, Cambridge

Held annually at different academic venues throughout the UK, this year's DRHA conference will be hosted by Cambridge with the theme 'New Communities of Knowledge and Practice'. This interdisciplinary event will be of interest to those managing and using digital resources in teaching, research, performance and practice. For further information and to register, please visit www.rsd.cam.ac.uk/drha08



22 October–2 November 2008

Arts, Humanities and Social Sciences Festival: 'Cambridge Festival of Ideas'

This new festival celebrates arts, humanities and social sciences at the University and its many partner organisations. Over 80 free events will be on offer to visitors of all ages. Activities include everything from Stone Age cooking to Viking culture. The full programme will be available from Summer 2008; to join the mailing list, please email Joanna McPhee (joanna.mcphee@admin.cam.ac.uk).

Are there areas of research that you would like to see covered in Research Horizons? We welcome suggestions, feedback and comments: please send ideas to the Editor at Research.Horizons@rsd.cam.ac.uk

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Your way into Cambridge

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

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

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

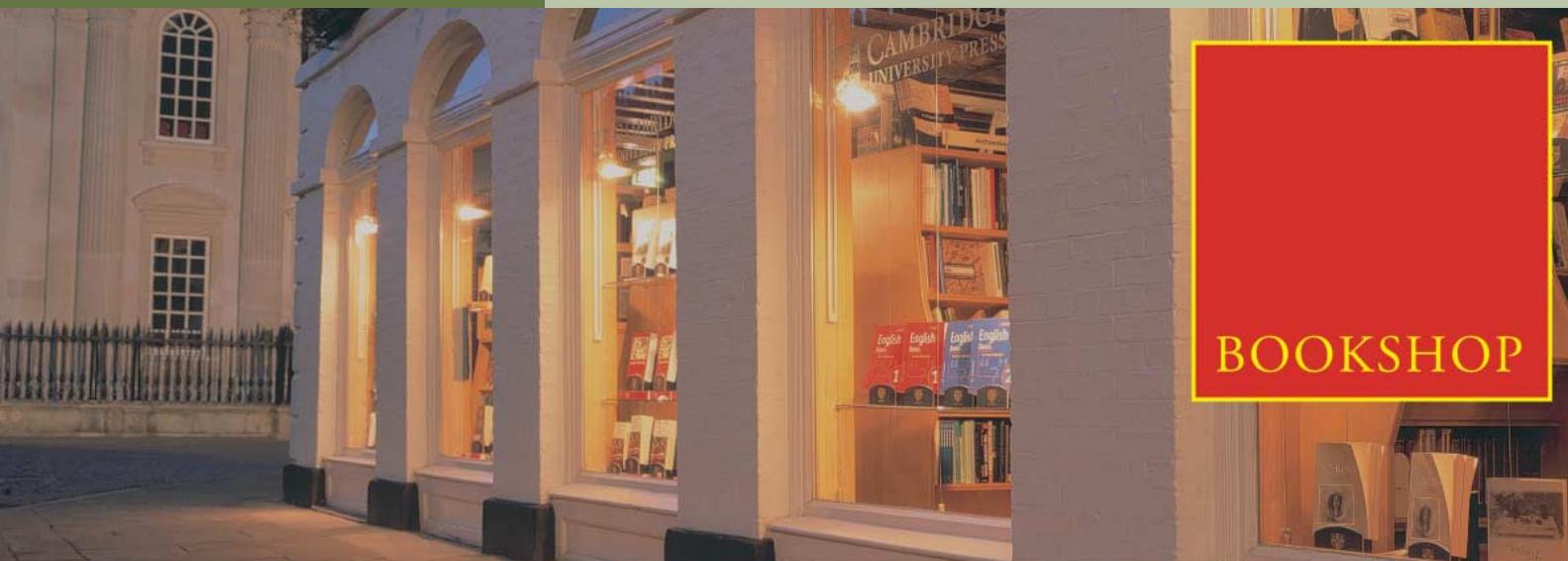
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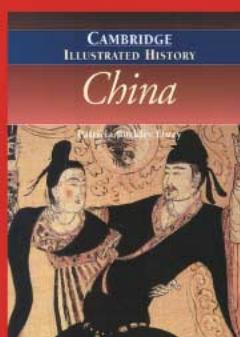
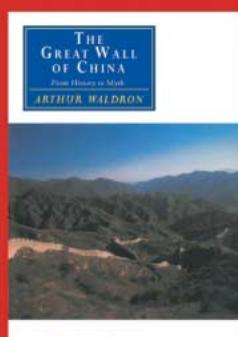
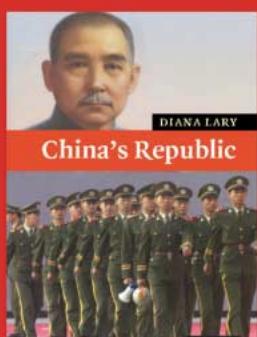
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