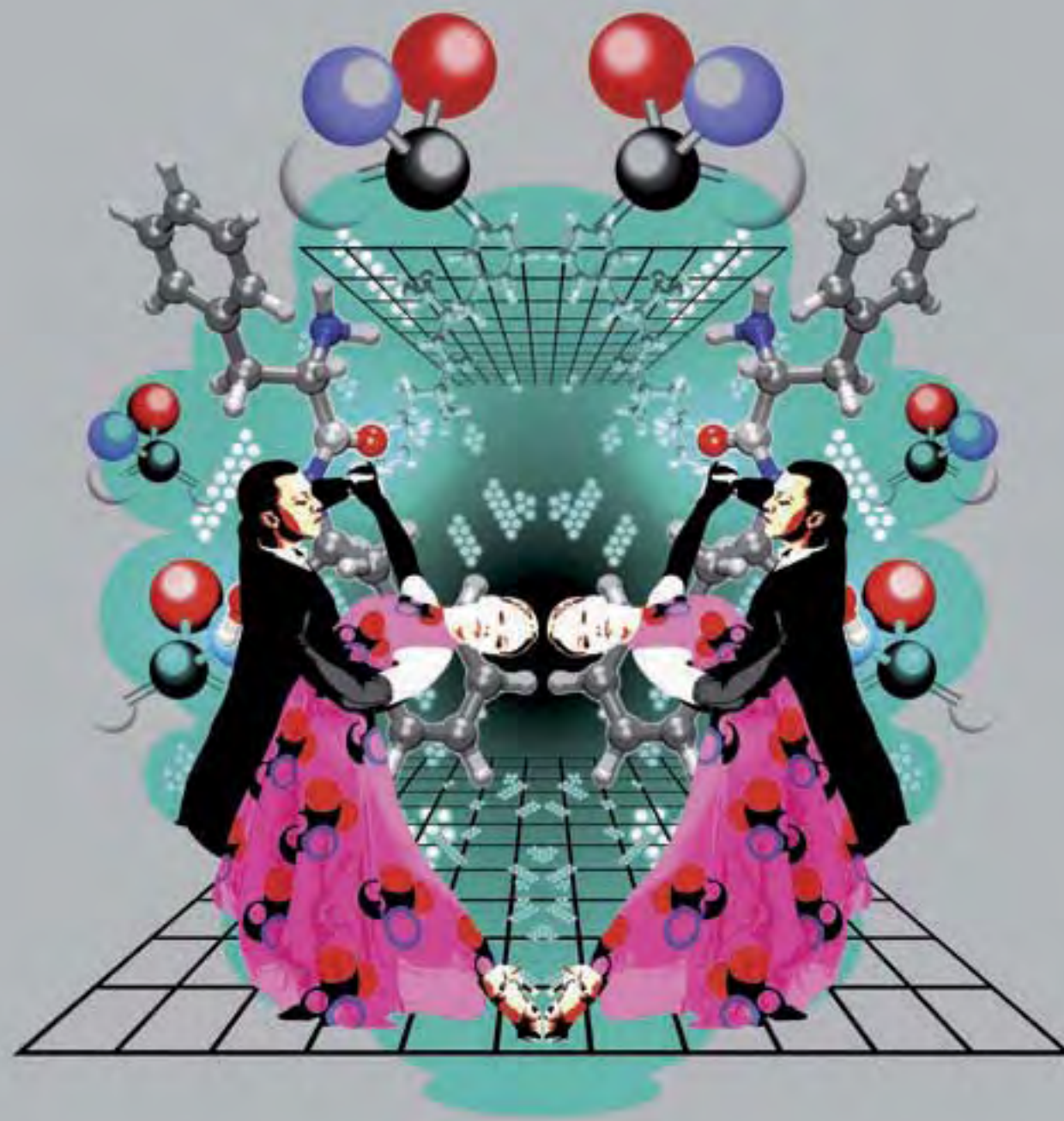


KING'S COLLEGE LONDON REPORT NUMBER 15 2007



# REPORT

NUMBER 15 2007



## THE CHIRAL TANGO

Cover illustration by Ray Smith

Using an approach that combines theory and experiment, Alessandro De Vita and Giulia Tomba from King's Department of Physics have been able to track the 'dance' of individual molecules, using giant supercomputers to explain the images caught by a team of collaborators from the Max-Planck Institut for Solid State Research in Stuttgart with a Scanning Tunnelling Microscope (STM). During the first stages of the assembly process, single molecules approach each other and change their conformation to form metastable pairs. This delicate process can take several minutes, and is successful only if the two interacting molecules have the same chirality (handedness), after which the pair starts a new chain. This is the first direct atomic-level observation of biological molecules changing their shape to form a stable bond, an idea put forward by Linus Pauling in 1947. This naturally-evolved, selective, self-assembly functionality is used here to build nanostructures in the new, human-controlled, conditions of the Scanning Tunnelling Microscope.

**K**ing's College London is one of the oldest and most distinguished university institutions in the UK.

It was founded by King George IV and the Duke of Wellington in 1829. The College community now encompasses more than 5,000 staff and nearly 20,000 students, based mainly in the heart of London. The student body is approximately one-third graduate and one-fifth international.

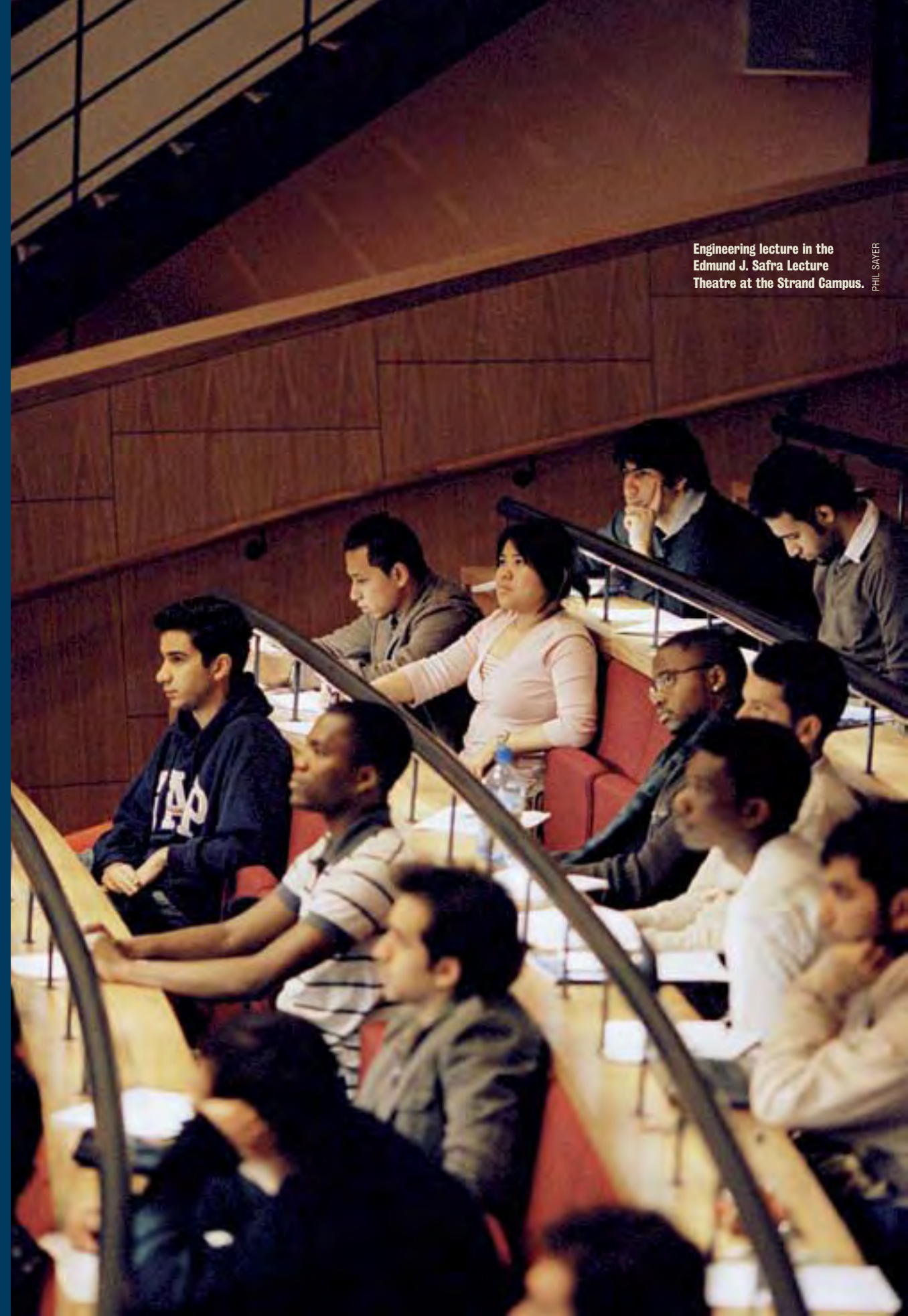
King's is a research-led institution. The College's academic staff are involved in research activity, often at an international level, and this activity informs the highest quality of teaching and supervision for both undergraduate and graduate students. As a result, King's is generally counted in the top ten British universities and within the top 50 universities worldwide. It is a member of the Russell Group of Britain's leading universities and is an independent college within the University of London.

King's is a multi-faculty institution, with nine schools of study: Biomedical & Health Sciences; Dentistry; Humanities; Law; Medicine; Nursing & Midwifery; Physical Sciences & Engineering; Psychiatry; and Social Science & Public Policy. It has five campuses, four of which are in central London and one at Denmark Hill in south London. Much of the College's medical, dental and health-related research and teaching is carried out in partnership with some of the world's most famous hospital trusts, including the Guy's & St Thomas' NHS Foundation Trust, the King's College Hospital NHS Foundation Trust and the South London and Maudsley NHS Foundation Trust. The College does, however, maintain complete independence from the National Health Service both financially and in management terms. King's is one of the largest university suppliers of research to UK government departments, and its government research contracts, such as those in the fields of medicine, international relations, education and the environment, help to inform the development of public policy both in the UK and abroad.

King's had a financial turnover of £388 million in 2005-6 of which £128 million related to grants from the Higher Education Funding Council and some £68 million was tuition fees and education contracts, comprising half the College's total income. The other half comes from research grants and contracts, endowment income and other activities, which is a considerably higher proportion from these sources of income than is achieved by most other universities. Governed by a Council with a majority of members drawn from outside academic life, King's is a chartered institution with considerable discretion over how it spends both its public and private income. In 2006 the College's financial strength was again awarded an 'AA-' financial rating by Standard & Poor's.

Engineering lecture in the  
Edmund J. Safra Lecture  
Theatre at the Strand Campus.

PHIL SAVER



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## Editor

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The King's REPORT reviews the College's work each year by featuring a sample of the research and teaching currently taking place in the College. It is the Principal's annual report to the College Council. This edition of the REPORT covers the academic year 2006-7.

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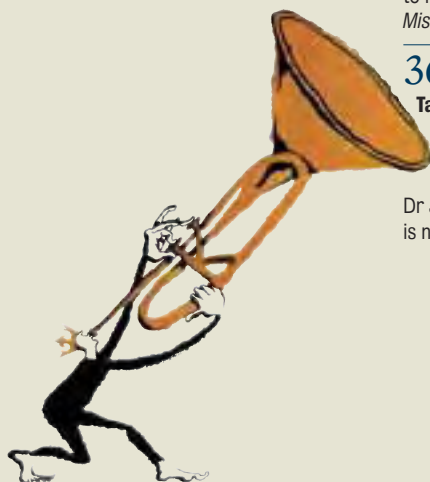
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Gifts to King's from individuals, grant-making trusts and other organisations.





# FROM EXCELLENT TO OUTSTANDING

**The Principal, Professor  
Rick Trainor, reflects on King's  
achievements in 2006-7.**



**'These achievements, and the others  
featured in this edition of the REPORT,  
indicate King's ever-more-prominent  
status as one of the country's leading  
university institutions.'**



**M**y introduction to last year's REPORT singled out the College's achievement in gaining two new Medical Research Council (MRC) research centres in 2005-6. This year I am delighted that we can report here on the work of a fifth King's MRC centre, on transplantation (see page 42). This addition means that the College now has more MRC centres than any other university, and that more than a quarter of all such centres are based here. I am also pleased to report that in December 2006 King's became the only English university institution to succeed in each of the three categories of the competition associated with the new research and development arrangements for the NHS. In the same month, moreover, we were invited to join the Global Medical Excellence Cluster launched by then then Prime Minister Tony Blair at 10 Downing Street.

### **Heart of London**

Our successes on the medical and scientific side have again been matched by achievements in humanities, law and social sciences this year. The College's location in the heart of London – one of the world's great cultural centres – and the academic excellence of our School of Humanities make it possible for King's to take a leading role in forging links between the arts and higher education, and in March 2007 the College was a key player in the inaugural conference of the London Centre for Arts and Cultural Enterprise. In my opening speech I pointed out that the arts and creative industries are critical to the UK economy, generating some £25 billion each year.

### **Academic impact**

Expertise in the College's Centre for Medical Law & Ethics (CMLE), in the School of Law, played a major part in persuading the MRC to site the Centre for Transplantation here, and it is therefore particularly appropriate that this year Professor Genevra Richardson of CMLE was awarded both a CBE and a fellowship of the British Academy (see page 51). This year has also brought us two new fellowships of the Royal Society and one further CBE (see page 9). The strengths of the College's connections in the public policy area were indicated this year not only by the visit of the future Prime Minister, Gordon Brown, to King's in September 2006, but also by the fact that the Chief Secretary to the Treasury, Andy Burnham MP, chose King's to announce the Brown Government's new policies for the public sector in July 2007. We also welcomed the then Minister of State for Science and Innovation, Malcolm Wicks MP, and Bill Rammell MP, Minister of State for Lifelong Learning, Further and Higher Education, to King's in 2006-7.

### **Degree awards**

These achievements, and the others featured in this edition of the REPORT, indicate King's ever-more-prominent status as one of the country's leading university institutions, and this was also reflected in 2007 by the College's acquisition of powers from the Privy Council to award degrees of King's College London rather than those of the University of London. It is our intention to take up this power from the academic year 2007-8, on a transitional basis. From next year King's will award its own degrees while remaining an active college of the University of London, which is a loose but academically useful



**'Patricia Rawlings FKC is the first woman to have chaired the Council, and her contribution over nine years to raising the College's global profile has been great and lasting.'**



federation. In the meantime, in March 2007, King's took the opportunity for the first time to award the University's honorary degrees to four people of international academic distinction, as reported on page 8.

### **Global profile**

Internationalism has been an important theme of our achievements in 2006-7. The year started for me in September 2006 with a memorable visit to South Africa to help launch the project to digitise the archive of King's alumnus Desmond Tutu, which will be carried out by the College's Centre for Computing in the Humanities alongside South African universities. In February 2007 the Chairman and I led a successful delegation to India to develop further links and raise the College's profile. Our visit culminated in a meeting with the President of India, Dr Abdul Kalam, and the announcement of five new scholarships for Indian nationals pursuing master's programmes at King's (see page 11).

In March Sir Lawrence Freedman, Vice-Principal for Research and Professor of War Studies, was presented with the International Security Studies Section Distinguished Scholar Award by the International Studies Association at a reception in his honour in the United States, in recognition of his contributions to the study of security. He became the first non-US scholar to receive this award. In May we published the College's Strategic Plan for the next decade, which sets out King's aspiration to become a leader on the international as well as the national stage. The College will build on its numerous accomplishments and formidable current advantages to become an outstanding university

institution, comparable in all respects with the best in the world. Just as REPORT was going to press we heard that King's had been ranked 24th in the world in the 2007 *Times Higher-QS* University Rankings, moving up from 46th place in 2006 and 73rd in 2005, confirming King's position as a centre of global academic excellence.

### **Leadership**

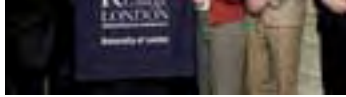
A major contributor to the College's increased distinction in the international sphere is Baroness Rawlings, who at the end of the 2006-7 academic year handed over the chairmanship of the College Council to the Marquess of Douro OBE. Patricia Rawlings FKC is the first woman to have chaired the Council, and her contribution over nine years to raising the College's global profile has been great and lasting. She has used her own generosity, discernment and persistence – not to mention her glamour, taste and charm – in fostering support for the College in many different arenas. She has been a most effective ambassador for King's, raising the profile of the College among the great and the good – and the generous – both here and overseas. Without her the College would not have been able to raise the funds needed for our magnificent Maughan Library, opened by Her Majesty The Queen in 2002, and for so many other important projects. Her excellent contacts on both sides of both parliamentary houses have smoothed the way for me and my predecessor as Principal, Professor Arthur Lucas, to meet important members of the government and the administration over the years. I am delighted that she has indicated that she will continue to support the College in further strengthening its profile as one of the world's leading universities in the years ahead. ■

# NEWS IN BRIEF 2006-7

ANDY LANE

## KING'S IN WORLD TOP 25

King's has been recognised as one of the top 25 universities in the world. The 2007 *Times Higher-QS World University Rankings* placed the College in 24th place, up from 46th in 2006 and from 73rd in 2005, confirming King's growing reputation as a centre of global academic excellence. The 2007 rankings reflect the views of more than 5,000 active academics worldwide and those of major global and national employers, and they also include data about staff/student ratios, citations of published papers, and a gauge of



JULIAN ANDERSON



universities' popularity based on the number of staff and students from overseas. King's is now the sixth-highest UK university according to these tables.

## ROOFTOP ART

Three life-size figures cast from his own body by Antony Gormley, designer of the *Angel of the North* and 1994 winner of the Turner Prize, stepped onto the roofs of King's buildings in May 2007 as part of *Event Horizon*, hosted by the Hayward Gallery on the South Bank. The two figures on the Franklin-Wilkins Building and one on the James Clerk Maxwell Building were part of a group of 30

figures installed on roof-tops in central London, spanning out from the Hayward Gallery, next door to King's Waterloo Campus

## TOP GREEN AWARD

The College was one of the 2007 winners of a prestigious Green Gown Award. The award in the 'Sustainable Construction' category recognised the reduced energy and carbon emissions from the refurbishment of the historic South Range of the College's Grade 1 Listed building at the Strand Campus, originally constructed in 1831. The two-year £40 million conservation-led redevelopment of the South Range has restored the elegant features of the 19th century building whilst providing a first-class environment for the 21st century. Original materials were redeployed wherever possible and maximum use was made of natural ventilation and daylight, with artificial cooling restricted to a few specialist areas and a subsequent reduction in energy costs.

**Right: The refurbishment of the Strand South Range won a Green Gown Award.**

## BROWN'S VISIT

Gordon Brown, then Chancellor of the Exchequer, made a special visit to King's in September 2006. His discussions with staff and students included issues facing higher education, specific initiatives in nursing and midwifery education and the College's groundbreaking Extended Medical Degree Programme (see page 52).

**Right: Gordon Brown with members of King's Florence Nightingale School of Nursing & Midwifery.**



DOMINIC TURNER



PHIL SAVER





Baroness Hale received one of the first honorary degrees to be awarded by King's.

**FIRST HONORARY DEGREES**

In early 2007 King's exercised for the first time the powers it has long held to confer honorary degrees of the University of London upon individuals who have made outstanding academic contributions to their field. The award of these degrees is a reflection and a reinforcement of

the College's ever-more-obvious status as one of the country's leading university institutions. The first recipient was Professor Joseph Nye, one of the world's ten most influential scholars of international relations. The other three recipients, whose degrees were awarded at a special ceremony in the College Chapel in March, were

Baroness Hale of Richmond, the first woman to be appointed a Law Lord; Professor Sir Alec Jeffreys, the geneticist who developed techniques for DNA fingerprinting and DNA profiling, and Judith Weir CBE, a distinguished composer and former Foundation Visiting Professor at Harvard University.

**APPLICATIONS RISE**

The number of people applying to study as undergraduates at King's increased by eight per cent in 2007, compared to the national average rise of 6.4 per cent. There was an exceptional 50 per cent increase in applications to the School of Physical Sciences & Engineering. Overall, this represents a rise in applications to King's of 2,346, to 30,115, with applications to the College in February 2007 up by 28 per cent on the previous five years' average. The five most popular subjects (Medicine; Management



King's is ever more popular with sixth-formers.



Studies; Law; Biomedical Science and Pharmacy) account for nearly half of the applications received in the current cycle.

### **VOLUNTEERING GOLD**

Kartik Muthusamy, a second-year King's Engineering student, was awarded a prestigious Gold Award from Student Volunteering England for his work with disadvantaged young people. Kartik attended a dinner at the House of Lords in July and gave a talk to the Lords about student volunteering. He is a football team manager for Street League, which uses sport to help young adults from disadvantaged backgrounds to achieve their potential, and he also volunteers every Sunday on a project which provides sports and recreation to children with special needs. Kartik became involved with volunteering through



**Kartik Muthusamy with fellow winners at the volunteering awards ceremony.**

KCLSU, which in June became only the second students' union in the country to achieve the Investing in Volunteers Quality Standard. In September the Union won the 'Most improved trustee board' category in the 2007 Third Sector Awards, in recognition of the forward-thinking governance structure which it has recently implemented.



**Professors Gillian Bates FRS and Michael Malim FRS.**

### **FRS, FBA AND HONOURS**

Prestigious honours and fellowships awarded to King's staff in 2007 included two FRSS, an FBA and two CBEs. Gillian Bates, Professor of Neurogenetics, who is distinguished for her key role in the cloning of the Huntington's disease gene, and Professor Michael Malim, Head of the Department of Infectious Diseases, who has made important contributions to understanding of the molecular biology of HIV, became fellows of the Royal Society. Geneva Richardson, Professor of Law, was awarded an FBA and also received the CBE in the Queen's New Year's Honours list of 2007. Professor Richardson describes some of her current research on page 50. David Armstrong, Professor of Medicine and Sociology in the School of Medicine's Department of General Practice & Primary Care, was awarded a CBE for services to medical research in the 2007 Queen's Birthday Honours. Fields Wicker-Miurín, a member of the College Council, was awarded an OBE at the same time for services to international business.

### **FINGERS POINT TO SPORTS SUCCESS**

Future female sports stars may be predicted just by looking at the length of their fingers. According to research conducted in the Twin Research Unit at King's, women whose ring fingers are longer than their index fingers should achieve higher levels in sports. The ratio of the length of the index finger to the ring finger has already been shown to be associated in men with



**Sports success is associated with a longer ring finger.**

diverse traits including cognitive ability, disease susceptibility, sexuality, sperm counts and aspects of personality. The new research involved examining hand radiographs of 607 female British twins aged between 25 and 79, and the participants ranking their highest level achieved in a list of 12 sports on a questionnaire.

**CHILDHOOD FRIENDSHIP AT RISK**

Professor Judith Dunn’s conclusion that children’s freedom to play out with their friends is being curtailed by adult anxiety about the modern world became the focus of media

attention when her survey for the Children’s Society was published in June 2007. *The Good Childhood Inquiry*, chaired by Professor Dunn of the Institute of Psychiatry at King’s, shows that anxiety about playing out unsupervised means that adults are denying today’s children the freedom to spend time with friends that they once enjoyed themselves. When asked the best age for children to be allowed out with friends unsupervised most respondents (43 per cent) said aged 14 or over, despite the fact that most of them had been allowed out without an

adult at the much younger age of 10 or under. The survey also revealed that early friendships last a lifetime, with 69 per cent of respondents saying they are still in touch with at least one childhood friend. These findings came in the wake of a report from UNICEF which revealed that the UK ranks at the bottom for peer relationships in international tables. Research also suggests that friendship in the UK is changing, and that since 1986 the number of teenagers with no best friends has increased from around one in eight to almost one in five, although children contributing to *The Good Childhood Inquiry* said friends are the most important things in their lives.

**PRINCIPAL HEADS UUK**

The Principal, Professor Rick Trainor, became President of Universities UK (UUK) in August 2007 and will serve until 2009. ‘This will be an exciting and challenging time for higher education’, Professor Trainor said, ‘and I know Universities UK will have a key role to play in shaping changes to come’. Previously, Professor Trainor was Treasurer of UUK. Having shed a number of other commitments outside the College, he will continue to be Principal of King’s alongside the Presidency of UUK.

**PROMS CONFERENCE FIRST**

King’s position as the most central university in arguably the world’s greatest city enhances its ability to form partnerships with the capital’s major cultural institutions. In April 2007 the



**£30 MILLION FOR PARENTING**

King’s, the Family and Parenting Institute and Parenting UK have been awarded £30 million by the Department for Education to create a new centre of excellence: the National Academy for Parenting Practitioners (NAPP), which will carry out parenting research and provide support for parents. NAPP will activate an ambitious research programme to find out the best ways to help children and young people achieve their potential and so help raise the standard of parenting support. It will provide a central hub for the exchange of ideas and learning and improve the quality of services for parents by raising the standard and consistency of practice and disseminating the evidence from research. It will also provide training and research opportunities for those who teach parenting skills in the community.



**King's position in central London enables the College to form important links with cultural institutions.**

College joined the BBC and the British Library in organising an international conference on *The Proms and British Musical Life* at the British Library. As conference convenor, John Deathridge, King Edward Professor of Music and Head of the Department of Music, introduced the main themes: the influence of the Henry Wood Promenade Concerts and the role of classical music in today's world. The Department of Music also has close links with the South Bank Arts Centre, English National Opera and the Royal Opera, Covent Garden.

### **NEW LINKS WITH INDIA**

The Principal and Chairman of College Council led a successful delegation to India in February 2007 to develop further links and raise the College's profile. The College hosted a major seminar in



New Delhi on *Perspectives on Terrorism – Europe & Asia* which made a significant contribution to the ongoing debate on global approaches to terrorism. The visit culminated in a meeting with the President of India, Dr Abdul Kalam, and the announcement of five new scholarships for Indian nationals pursuing master's programmes at King's. Each scholarship will provide a contribution of £4,000 towards the overall tuition fee for international students, and preference for their award will be given to students who have not previously studied outside India.



**£14M HEALTH FUNDING**

The College learned in April 2007 that it has been awarded £14 million for seven projects researching into areas including mental health, medicines for children, diabetes, stroke and dementias. Six academics from the Institute of Psychiatry and one from the School of Medicine have secured around a third of the £45 million available overall for the UK. Ulrike Schmidt, Professor of Eating Disorders, was awarded a grant worth £1.9 million to conduct research on resources for the identification and treatment of anorexia. Other funded projects include treatments for people with neurodevelopmental disorders; care for patients with depression and physical illness; means of improving physical health and decreasing cannabis abuse in people with severe mental illness and non-pharmacological approaches to improving diabetes outcomes.

PHIL SAVER



**Peanuts may be protective.**

**PEANUTS ON TRIAL**

King's scientists are conducting a major clinical trial into the causes of peanut allergy. Nearly 500 babies between four and 11 months old who already suffer from allergies will take part in the £5 million, seven-year study. Recent evidence suggests that children who eat peanut snacks early in life may in fact be protected against peanut allergy, in contrast with previous studies which have suggested the opposite.

**HRH OPENS FLAGSHIP CENTRE**

Her Royal Highness The Princess Royal, Chancellor of the University of London, formally opened the £30 million James Black Centre at King's Denmark Hill Campus in January 2007. The new Centre brings together more than 200 scientists researching cardiovascular

disease, neuroscience and sickle cell disease, with a major focus on stem cell research. The Centre is funded by donors including the government's Science Research Investment Fund, the King's Medical Research Trust, King's College Hospital Charitable Trust and the British Heart Foundation. It is named after Sir James Black OM, Emeritus Professor of Analytical Pharmacology at King's, who received the Nobel Prize for Physiology and Medicine in 1988 for the development of beta-blockers and anti-ulcer histamine receptor blocking drugs.



**The Princess Royal meets Nobel Prize winner Sir James Black OM.**

**SLOWER AGEING WITH MOLES**

People with large numbers of moles on their skin may age slower than expected, according to a study from King's. Researchers studied the skin and telomere length (a marker of biological ageing found on all cells in the body) of more than 1,800 female twins, and found that people with a high number of moles had longer telomeres. The 10-year study from the Twin

GREG FUNNELL

Research Unit was funded by the Wellcome Trust and published in the July 2007 edition of *Cancer Epidemiology Biomarkers & Prevention*. Moles appear in childhood and disappear from middle age onwards. When present in large numbers they can increase the risk of melanoma, a rare form of skin cancer. Moles vary significantly in numbers and size between individuals. The average number of moles in people with white skin is 30 but some people may have as many as

400, and they vary in size from 2mm in diameter to well over 5mm. The Twin Research Unit has already shown in a previous study on over 2,000 twins that up to 60 per cent of susceptibility to moles is inherited, but the reason for such differences, and the function of moles, is unknown. The Twin Research Unit at King's has a database of 10,000 twin volunteers, male and female, identical and non-identical, and studies a wide variety of diseases and traits.



**Dr Pat Reynolds and colleagues are pioneering new ways of teaching dentistry.**



### **ONLINE DENTAL TRAINING**

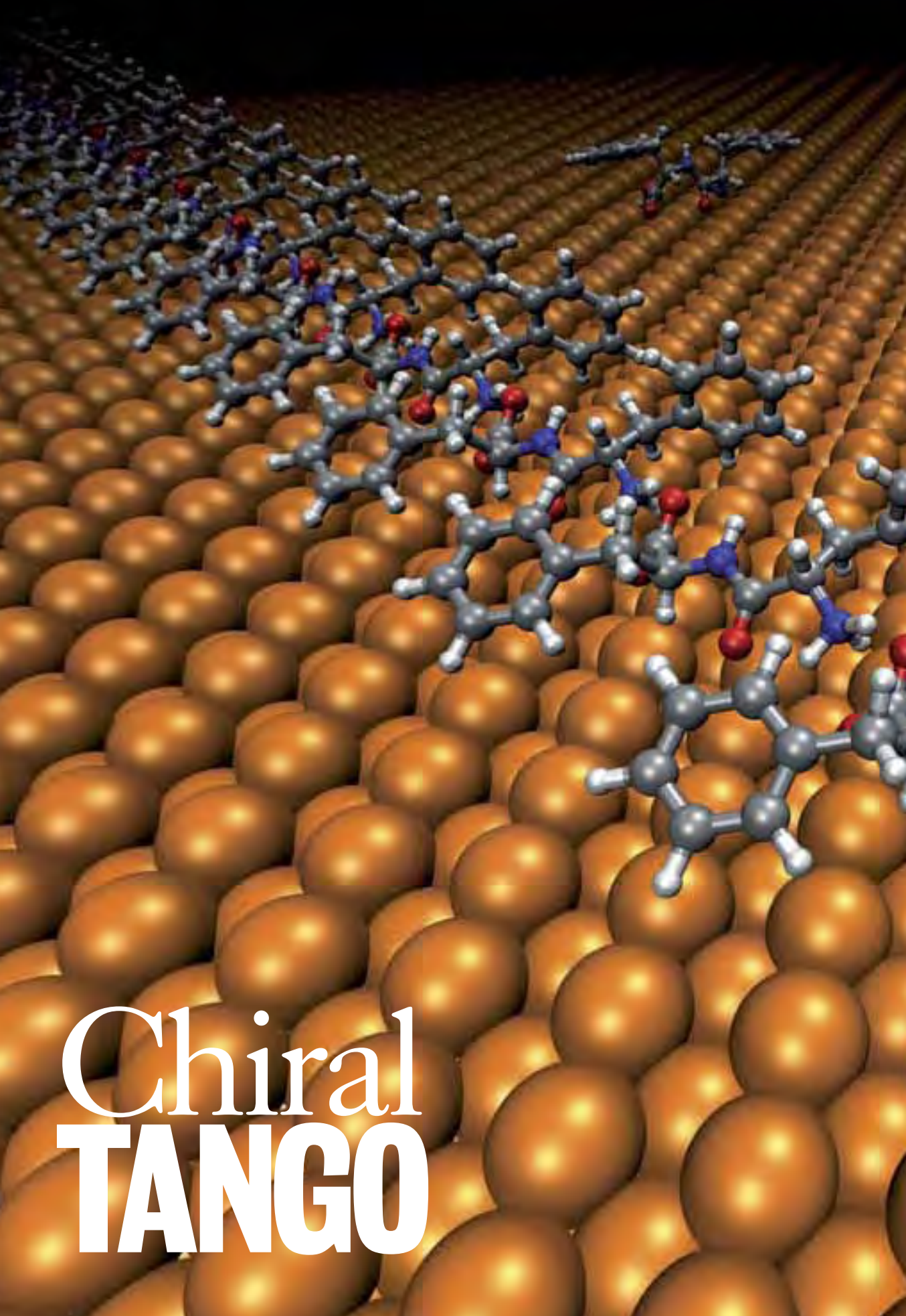
King's Dental Institute has secured £2.3 million over three years for an innovative online learning project to train dentists in specialist subjects, largely funded by the Higher Education Funding Council for England and the Department of Health, which will help to overcome the shortage of appropriately qualified teachers in specialist disciplines such as dental radiology, oral medicine

and pathology. The new elearning platform allows students access to online teaching, learning, support and services from enrolment to graduation and beyond, and dental schools will be able to customise the platform according to their specific needs. The project will be run by **IVIDENT** (the International Virtual Dental School): a self sustaining, non-profit making business enterprise which brings together several UK universities. ■

### **PHANTOM TOUCH**

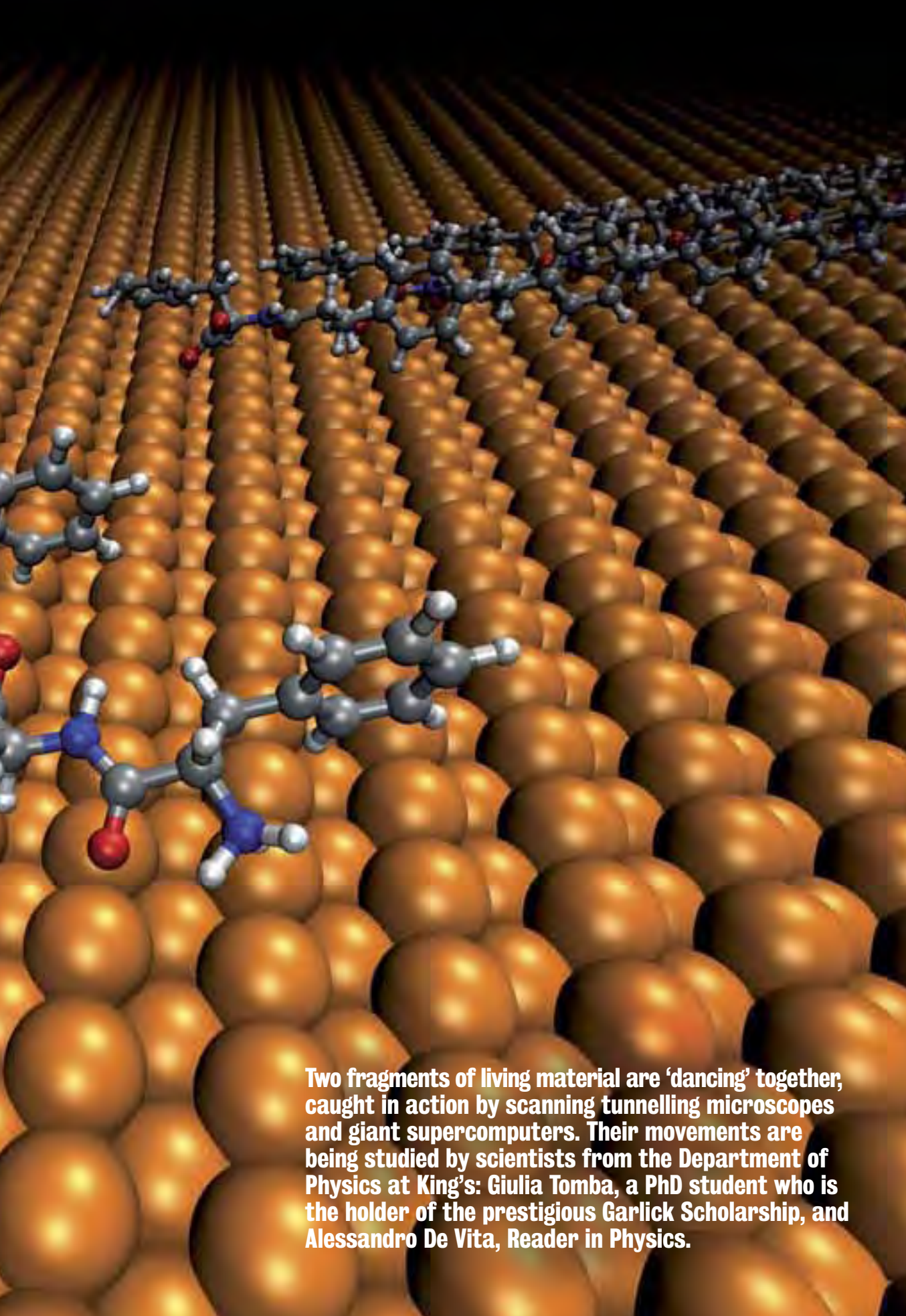
A new synthetic device which will enable dental and other students to practise their skills on a very realistic virtual patient without the worry of causing harm, embarrassment or fear is being designed by experts at King's. The **PHANTOM** project brings together a team of elearning, robotics and clinical specialists with a psychologist and sociologist who have extensive experience in dental education, to create a set of haptic (ie touch-sensitive) devices and online virtual 3-D environments which can be used by dentists, nurses, hygienists, general practitioners and veterinary surgeons. A series of tasks and an aptitude test will be used to see how these devices can help learners improve their manipulation and three-dimensional perceptual skills and how this might change their attitudes to the real techniques and to their competencies. ■





# Chiral **TANGO**





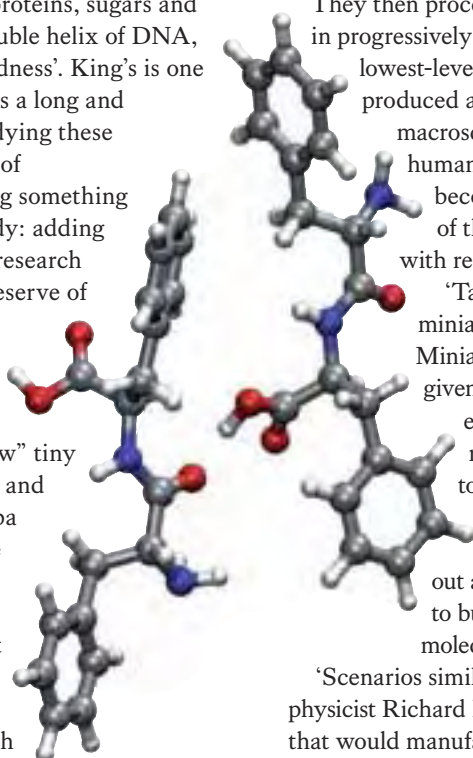
**Two fragments of living material are 'dancing' together, caught in action by scanning tunnelling microscopes and giant supercomputers. Their movements are being studied by scientists from the Department of Physics at King's: Giulia Tomba, a PhD student who is the holder of the prestigious Garlick Scholarship, and Alessandro De Vita, Reader in Physics.**

**T**wo small proteins meet and begin to bind: forming seeds that have the capacity to grow into tiny, nanometre-scale structures. Using a Scanning Tunnelling Microscope, the scientists Tomba and De Vita have observed that when – and only when – the two molecules meet, they radically change their shape to optimise mutual bonding, and that it is only at this point the proteins unite permanently. In order to accomplish this bonding, the molecules dance around each other for several minutes – a comparative eternity in molecular time-scale.

As a hypothesis, this process was outlined some 60 years ago by the American chemist, biochemist and double Nobel Prize-winner, Linus Pauling, who nearly beat Crick and Watson of Cambridge, and Franklin and Wilkins of King's, in the race to discover the structure of DNA. It is, however, only now, in 2007, that this dance has been caught on film for the first time.

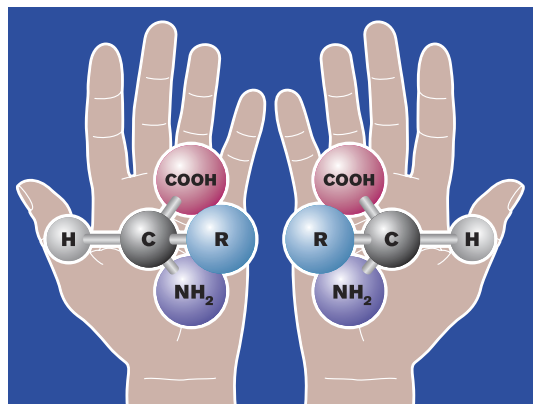
Intriguingly, the molecules can bind effectively only if they have the same expression of a fundamental property of proteins, sugars and (most importantly) the double helix of DNA, called chirality, or 'handedness'. King's is one of the places where there is a long and important tradition of studying these molecules, but the advent of nanotechnology is bringing something absolutely new to this study: adding an engineering flavour to research that is traditionally the preserve of biochemistry and physics.

'We're now at the stage when we're trying to learn from Nature's own methods how to "grow" tiny structures with the shapes and properties we want', Tomba and De Vita explain. 'The automation and precision that are emerging in the new studies we're doing at King's are crucial requirements for a new and revolutionary approach



**Below top: Objects that are mirror images of each other, but not superimposable, are said to have chirality, or 'handedness'. These two amino acids have the same property. Those which the human body uses to build proteins are, however, all of the 'left'**

**variety, necessary for them to work well together. Below centre: Computer model of two diphenylalanine molecules of opposite chirality trying to bind to each other, but not succeeding due to their incompatible shapes.**



RUSSELL BELL

in human manufacturing. Known as "nanofabrication by self-assembly", this has huge potential for future applications in molecular electronics and biomedicine.'

#### **From 'top-down' to mass-production.**

Human technology, so far, has taken a 'top-down' route. 'When humans want to create a useful object, even a complex one, they typically start by taking an overview', Tomba and De Vita explain.

'They then proceed by defining each of its parts in progressively greater detail, down to the lowest-level components which must be produced and assembled using appropriate macroscopic tools (ie those scaled for human use). This kind of approach becomes troublesome when the size of the desired object gets too small with respect to our own size scale.

'Take, for example, the quest for the miniaturisation of electronic devices. Miniaturisation is highly desirable: given that the speed of light and electric signals is finite, the only route to faster and faster devices is to make them smaller and smaller.

However, in spite of intense effort, so far no one has figured out a "top-down" lithographic process to build in one go an entire chip of molecular-scale electronic components.

'Scenarios similar to the 1959 prediction of physicist Richard Feynman (ie building a machine that would manufacture four other machines one-

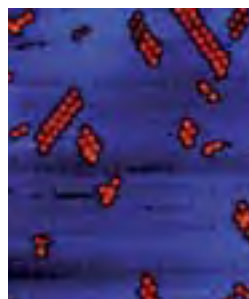
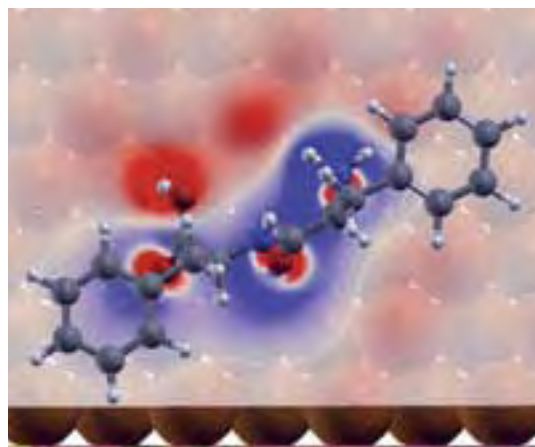
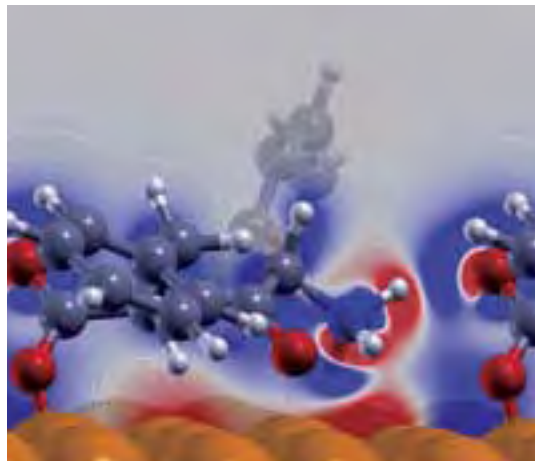


fourth its size, each of which would in turn assemble four tinier replicas, and so on, down to the atomic scale) are still very far from present realisation. Although current technologies enable humans to build nano-sized molecular electronic components, every component needs to be built individually, with great care and attention, using a macroscopic machine. Thus, humans are still very far from achieving the mass production of nano-sized electronic devices: because there simply isn't enough time to build appreciable quantities of these.'

#### Nature's 'bottom-up' self-assembly

These problems are leading to a tentative new approach in the budding field of nanotechnology: using simple, appropriately-tailored molecular building blocks which can assemble themselves into complex structures without further human intervention. 'We know that this is possible,' Tomba and De Vita say. 'It's a fascinating fact of the biological world that all living organisms, from the simplest to the most complex form, are the products of self-organisation evolved through natural selection. Their smooth functioning is the result of concerted self-assembly processes, from the most elementary "bottom" level – interacting atoms and molecules – up to structures of very high complexity and significance such as a cell, or a human brain.

'In principle, all we need to do is to observe and imitate the biological processes. But even observing them is far from easy. Molecular motion is so fast that it cannot be watched directly: our observations often give us just a few glimpses of the phenomena we're interested in. Furthermore, basic biological processes such as DNA replication and protein folding take place inside the cells, so they are not accessible to most detection methods. It has recently been realised, however, that we can adjust our observation conditions to overcome many of these limitations. Many process rates can be dramatically slowed down by controlling temperature, and many molecular assembly phenomena retain most of their pre-eminent features, even well outside their natural environment. For example, tiny proteins can function on a



Above: Scanning Tunneling electron microscopy experimental images of diphenylalanine molecules forming chains on a copper surface, without human help (a spontaneous, 'self-assembly' process).

Above: Chemical bonding between diphenylalanine molecules and a highly pure, atomically flat, copper surface on which they are adsorbed (top panel: side view of adsorbed molecules, bottom panel: top view of an adsorbed molecule). Red and blue lobes indicate regions of accumulation and depletion of electronic charge determined by the bonding, as obtained by Quantum Mechanical calculations performed on massively parallel computers.

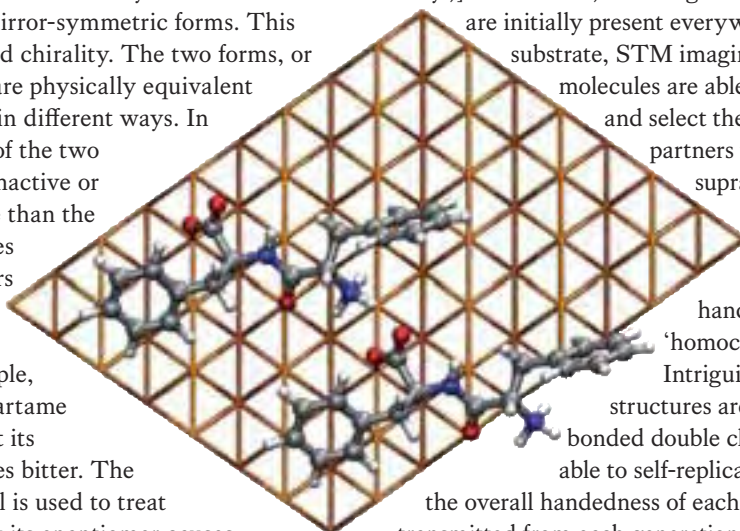


**Below: Computer-generated model of two diphenylalanine molecules bound to each other and ready to start a chain.**

completely dry, highly pure metallic substrate and in an ultra-high vacuum. Here their behaviour can be observed directly and in unprecedented atomic-scale detail, using a Scanning Tunnelling Microscope (STM).'

### Chirality matters

'Through the microscope, we can "see" the molecules and appreciate their properties. We immediately notice that many molecules exist in two different, mirror-symmetric forms. This property is called chirality. The two forms, or "enantiomers", are physically equivalent but can behave in different ways. In most cases one of the two enantiomers is inactive or much less active than the other. Sometimes both enantiomers are functional, but in different ways. For example, commercial aspartame tastes sweet, but its enantiomer tastes bitter. The drug ethambutol is used to treat tuberculosis, but its enantiomer causes blindness. To understand chirality and its role we can consider our hands: right and left, they are each other's mirror image but they are clearly different and distinguishable. The concept of chiral recognition, or "stereo-selectivity", immediately follows: whenever we shake hands, it is our right hand we put out, because two right hands can fit properly into each other. Of course, two left hands would do equally well: the correct handedness is a contextual property (as British drivers abroad know full well!). In the biological world the conventionally correct handedness was decided, once and for all and probably just by chance, billions of years ago. The DNA and RNA of every living being are now all right-handed, while most amino acids in proteins are left-handed. As a rule, a biological polymer will be able to function only after self-assembling from component molecules that all have the same handedness.'



### Building a chiral double chain

By and large, biological processes are stereo-selective: ie biomolecules will recognise other molecules that have the correct handedness to build functional supra-structures. Several studies have shown that many other molecules adsorbed on metallic substrates behave in the same way. An outstanding example is provided by experiments on the PVBA molecule (4-[trans-2-(pyrid-4-yl-vinyl)]benzoic acid). Although both its enantiomers are initially present everywhere on the substrate, STM imaging reveals that the molecules are able to move, interact and select their 'successful' partners to build ordered supra-molecular structures with an entirely uniform handedness (ie a 'homochiral' character). Intriguingly, these structures are long, hydrogen-bonded double chains, which are able to self-replicate. Furthermore, the overall handedness of each double chain is transmitted from each generation to the next, creating large homochiral populations – a process reminiscent of DNA replication, although happening in just two dimensions. A series of very regular parallel, macroscopic PVBA chains, or 'gratings', can be constructed this way.

### What makes a good dancer

But how exactly does the biological recognition/selection process take place? This issue has been the object of an intense debate which has led to various theories. Emil Fischer's early 'lock-and-key' model for enzymes (1894) suggested that the two interacting units – an enzyme and its substrate, for example – can react if they have complementary shapes that fit exactly into each other. Such a static picture, however, overlooks the fact that most biological molecules are flexible and can encode some of their functionalities in their ability to change shape.

If we think again of the hand-shake example,

**Below Sequence of photograms showing two diphenylalanine molecules of the same chirality, initially placed far away, approaching each other, 'dancing' for a while and**

**finally locking into a permanent dimer configuration, for which they must change their internal conformation, as signalled by the new orientation on the plane (last photogram).**



we realise that the two meeting hands have to be close on each other in order to bind effectively. A similar idea was first introduced by Linus Pauling in a famous talk on *Molecular Structure and Biological Specificity* given at the Royal Institution in London in 1947. Pauling speculated that an antibody molecule can change shape upon interaction with the antigen, after which a stable bond between the two can be established. This 'induced fit' model is today the generally accepted picture of biomolecular recognition processes, also expected to apply to self-assembly chiral recognition processes.

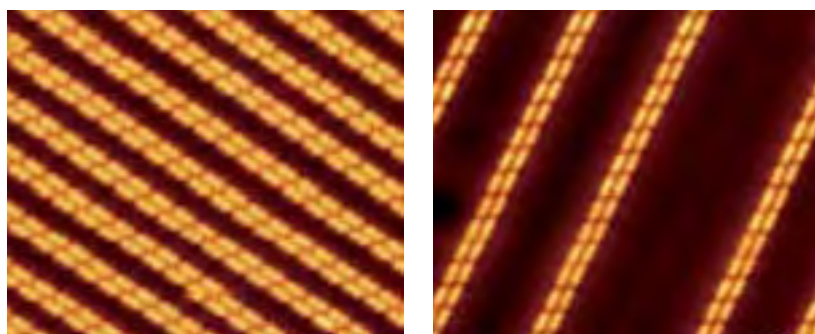
It is this mechanism that has now been observed directly 'in action' by a team of researchers from King's College London, the Max-Planck-Institut for Solid State Research in Stuttgart (MPI) and the Fraunhofer Institut in Freiburg (FI).

### Caught on film

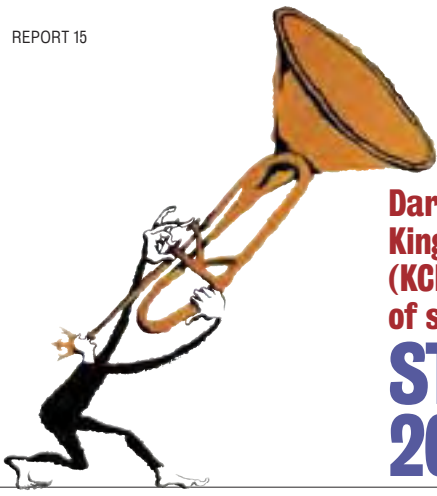
Using an approach that combines experiment and theory, the teams from King's, MPI and FI teams have been able to track the 'dance' of individual diphenylalanine molecules (a biological sequence involved in recognition processes related to BSE and Alzheimer's diseases). In the last two years they have been able to observe their interactions

and assembly patterns. As in the example above, these molecules can be used to build highly ordered chains. During the first stages of the assembly process, single molecules approach each other and form metastable pairs: a process that can take several minutes. When the two interacting molecules have the same chirality, the pair evolves into a stable pair, and starts a new chain. On the contrary, pairs made of opposite enantiomers eventually disrupt. Intriguingly, whenever two molecules interact, they change their orientation with respect to the substrate in a very precise way. Quantum mechanical calculations reveal that this is due to a mutually-induced change of shape of the molecules. Taking all these results together, this is the first direct atomic-level observation of biological molecules changing their shape to form a stable bond, and the exquisite accuracy and robustness of the process confirms Pauling's intuition of 1947.

It has taken 60 years to prove his hypothesis, about a natural process that has evolved over billions of years, but the progress that has been made since then has been rapid, and it is already becoming possible to use this naturally-evolved, selective, self-assembly functionality to build nanostructures in the new, human-controlled, conditions of the Scanning Tunnelling Microscope. ■



**Left: STM images of PVBA molecules forming 'gratings' of adjacent double chains. The double chains are formed one after the other, each one 'inheriting' the chirality of its parent chain, similar to what happens during the DNA replication process. This way entire populations consisting only of 'left' or 'right' double chains can be obtained, as seen in the two panels.**



**Daryn McCombe, President of King's College London Students' Union (KCLSU) for 2006-7, describes a year of student achievement.**

## STUDENT DIARY 2006-7

It puts a smile on my face when I think about this year and the fact that we have extended opportunities to take part in student activity to a larger audience, that our campaigners have been louder in campaigning for what they want and our students have spent longer volunteering. And it is these adjectives, 'larger', 'louder' and 'longer', that I believe reflect the future of student participation at King's. I stood for President because I wanted to build a brighter future for our students and I think that, although we have a long way to go, we have well and truly set off on that journey.

It positively amazes me how involved students can be, with all the pressures brought about by the introduction of top-up fees, a competitive job market and, in the majority of cases, the need to offset London living costs with part-time work. All these elements result in a student's time being at a premium. Time may be limited in quantity, but it has been clear from the awards that we presented at the KCLSU awards ceremony in May that it is by no means limited in quality. King's students have once again been achieving: on the sports field, on the national stage and through international development. Many people have benefited from the hard work of King's students this year.

### Gold award

This year for the first time a student volunteer from King's was awarded a gold award from Volunteering

England. Congratulations to Kartik Muthusamy, a second year Engineering student, who won the award for his volunteering work with disadvantaged young people. Kartik attended a dinner at the House of Lords in July and was chosen to give a talk to the Lords about student volunteering.

### Ragtime

Our campaigning groups who worked so hard last year to achieve Fairtrade status worked tirelessly to renew that status for another year. It was also hard work that led to six sports teams coming top of their

### Clubbing it

This year we have ratified 34 new clubs and societies, including Russian, Portuguese, Korean and Palestine societies, to name but a few. We have seen demand for an unprecedented number of new cultural and international groups, and it is this diversity (only matched by the excellence of their activity) that helps put that smile on my face. We have seen the formation of a further three new campaigning groups whose aims laudably include promoting refugee issues, campaigning against child poverty and raising awareness about bone



national leagues, and hard work by the medical community RAG week committee that raised over £100,000 for our hospital-based charities. And, in addition to all that, our students who stood to be candidates in the Students' Union election worked so hard to achieve a higher turnout in the elections for the RAG committee, the Medical Society and the Student Council.

marrow donation. I have seen our students set up excellent new student-led volunteering projects such as 'Mildmay', which gives volunteers the chance to offer comfort to HIV patients, and a new 'Children's Musical Workshop' run by the Musical Theatre society, that visits London schools and runs musical, acting and dance classes with the children.



## Street Law

On top of all that, our volunteering department is working with the Law School to set up 'Street Law', a unique project that will allow law students the opportunity to educate school children about the parts of the law that they might come into contact with on a day-to-day basis. It has been no surprise to me that this project has had the highest-ever number of students showing an interest. The challenge for us has been to keep up with the ambitions of our students, and so an increase in their activity has warranted an increase in our internal capacity. We have increased our organisation's capacity by a third to meet this outstanding demand.

## National stage

I haven't even begun to mention some of the achievements of our part-time elected representatives: the students who have the enviable task of representing our needs through Student Council, as delegates to the University of London Students' Union (ULU) and at the Annual Conference of the National Union of Students (NUS). King's has been recognised year on year as being one of the most active students' unions in London and on the national stage. It is thanks to the hard work of our delegates to ULU and NUS that our calls for governance change were adopted by NUS Conference and recently by ULU Council.



## Partnership

This year we have built a partnership between the Students' Union (KCLSU) and the College. KCLSU has been working with the Principal and other staff within the College, maturing our thoughts, meeting, and discussing the way forward for the College and the Union, and – most importantly – winning on the issues that our students care about. Building on our successes and working with the College we have, amongst other things, expanded last year's pilot project for the libraries and information service centres to be available 24 hours a day and seven days a week on all our main campuses, and secured extra facilities so that students have space to rest and relax away from their books after the normal closing hours. The rent increase for student halls 2007-8 will be three per cent less than it was last year, thanks to our agreement. The Chair of College Council, the Principal and the staff of the College work hard

to ensure that King's is on its way to become a world-class institution, and without this and their willingness to work with us, KCLSU would not be in the position it is today. So thank you!

Personally, my year has been a never-ending round of meetings, presentations, lunches and dinners. I've met the Prime Minister, The Princess Royal, Hilary Benn MP, and Frank Lampard – not quite the usual suspects for your average student activist! And as my year draws to a close I know that the superb team of students, and staff who are behind us, the visible faces of KCLSU at all times, will continue the outstanding work that has started this year. Without the never-ending examples of student achievements, dedication, and their constant drive to do better, I would have had little to write about except the high-minded musings of a mere Theology student. ■





**WAAAT**

Nor any drop to drink



# TER

**Drought and flooding have put water at the top of the agenda, both in the UK and worldwide. Professor Tony Allan of the King's Water Research Unit explores what the rest of the century may hold in store for water resources, and describes how King's researchers are contributing to the debate.**



**K**ing's has a rich research capacity in the water sciences. It also has public policy expertise in highlighting the critical features of water resources that need to be understood if communities and their environments are to be water secure. An important question being asked by those who worry about global water security is whether there will be enough water for these communities and environments at the end of the century?

The water research agenda is shaped by global circumstances. Water resources have been driven very hard since the 1950s. More people need more water. The global population has trebled to 6.5 billion and it will increase by about two billion more by the second half of the century before levelling off. King's research has been fundamental in showing how local water scarcities have been successfully addressed by farmers and traders.

### **Productivity**

About 90 per cent of the water needed by an individual or a national economy is used for food production. Since the 1950s, farmers have increased production and productivity. Traders have moved food commodities to locations where they have been needed. Farmers have been particularly successful in industrialised countries. Yields of wheat languished at one tonne per hectare in England between 1600 and 1800. They rose to two tonnes by 1900 and to three tonnes by 1950. By 1990 they were about nine tonnes. All this grain was rain-fed and, as rainfall has not changed significantly, the story of English wheat production is one of spectacular increases in returns to water, especially in the recent past. Research at King's is testing the extent to which agriculture in non-industrialised economies has the potential to emulate the productivity increases of north-west Europe.

Our water research agenda does not neglect the downside of the industrialisation of farming. Higher productivity has been associated with very high energy inputs for cultivation, for fertilizers and for pesticides. The consequences for the water environment are also highly significant, and impact

on the water needs of rivers and wetlands and their ecological status and their capacity to sustain ecosystem services. Research at King's on this essential topic feeds into improved river management across the globe.

One of our current research priorities is the impact of additional demands on agricultural water resources. Bio-fuel production requires water to produce energy. This is a reversal of the pattern of the past half-century, when fossil energy replaced animal traction. When draught animals were withdrawn in the 1930-1950 period, 20 per cent of productive land and water previously used to feed draught animals was released to grow food for society. The mechanisation of farming in the past half-century was just one of many technical advances over the millennium that have driven down agricultural commodity prices. The price of grain, for example, has been falling for 500 years; some would argue for 1,000 years. The global system is, however, about to experience a sustained, and probably unprecedented, increase in staple grain prices. Both the benefits and challenges of this new economy are being researched at King's.

### **Worldwide**

Water research at King's is not limited to the economically diverse OECD countries. We are also addressing water resources management problems in Asia, Africa and the Middle East. In the second half of the 20th century, farmers in China and in the economies of South Asia rose to the challenge of meeting the rising demand for water and food. They and their governments both mobilised more water and used it more productively. During this period they have increased their production of wheat and rice by four or five times, mainly by using more extensive and more efficient irrigation. But, as in Europe, the environmental price has been high.

The powerful explanatory concept of 'virtual water' was coined by a King's researcher to explain the absence of armed conflict over water in Africa and the Middle East. Virtual water is the water needed to produce food and other commodities. One thousand tonnes (cubic metres) of water are

**Below: Women transplant rice-seedlings in paddies, Thailand.**  
**Below left: Water buffalo in a rice field in Vietnam. Farmers in South Asia have increased their production of wheat and rice by four or five times since the 1950s.**

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needed to produce a tonne of wheat. Low value water in the soil profiles of North America, Europe, South America and Australia produce volumes of wheat surplus to local needs. When wheat is imported to a water-short economy (such as those of the Middle East where water is costly) it enables them to avoid serious economic and political stress in reallocating heavily over-used local water. These food imports have the additional

benefit of making it possible to leave water in the local environment to maintain the environmental services of water, such as ensuring minimum river flows that sustain ecological status and biodiversity. Used first to explain the absence of armed conflict in water-scarce regions, the main contribution of the concept has, however, been in explaining how regional economies have coped with their transitions to serious water scarcity. They have been further helped, at least in the past, by the wheat-exporting economies putting commodities such as wheat on the world market at half its actual cost.

**Environmental science**

King’s has an internationally recognised reputation for its research on water in the environment. There is a high demand for such science in Europe, since EU countries are in the lead in remedying the impacts of industrialisation and of intensified farming. Water scientists play an essential role in



Left from top: **Flooding in Ghana; Irrigating a rice-field in Vietnam; Women fetching water in Ghana.**  
Opposite: **Fishing in Ghana.**





**About 90 per cent of the water needed by an individual or a national economy is used for food production.**



providing policy-makers with information on the status of the water environment. Governments and European agencies, industrial interests and (especially) environmental activists all need sound science. King's water scientists have close relations with professionals in all these water-using, water-managing and social audit institutions. For example, implementation of the European Water Framework Directive depends upon a robust scientific understanding of the functioning of surface water and groundwater systems.

Over the last few decades, King's researchers have made significant contributions to understanding the causes of changes in the physical, chemical and biological status of streams, rivers and wetlands. They have developed widely-adopted assessment and remediation measures. A particular focus has been on improved understanding of urban rivers and the potential benefit of enhancing them, for both city-dwellers and river organisms. New approaches to urban river restoration have been established. King's researchers are also actively involved in assessing the potential impacts of climate change on rivers and their catchments, including changes in the risks of river flooding.

**Communicating water science into policy**

A major priority of the King's water research community is the communication of our science into policy-making processes. Both social scientists and water scientists at King's recognise that

knowledge-based policy is not the norm. Policy-making is a political process. The politics that shape policy respond to the voices of society and of those generating goods and services in the economy and also to the voice of the environment – if it has been given a voice by environmental activists. Water science, which operates in a world of probability, can identify underlying fundamentals that should be recognised if a sustainable environment is to be kept in place. For those wanting to have their knowledge taken into account in the policy domain, the trick is to understand the role, and the skills, of the politician, and the rough and ready ways of politics in dealing with uncertainty. The politician was invented to deal with uncertainty, and politics to deal with the unavoidable (and usually disagreeable) business of allocating scarce resources. The College has considerable expertise in researching power relations over water at the local level, in what is called 'political ecology'. At the level of international relations the terms used are 'transboundary waters' and 'hydropolitics'.

There is a strong demand for new ideas on the subject of international relations over shared waters. Even more sustained is the demand for accessible science on the status of water resources in the UK and internationally. The remediation of freshwater bodies is a current priority. For example, how are river channels to be rehabilitated that have been severely affected by past engineering infrastructures – misconceived to be protective against flooding? The biology and chemistry necessary to manage freshwater bodies for fish and other freshwater creatures, plants and micro-organisms is also needed.

The growing need for clean potable water worldwide is another research focus, within the contexts of development, poverty and conflict. We are giving increasing attention to the question of how nations and communities invest in water services at the level of the family as well as that of the economy. The roles of poverty and gender are major concerns. These science/policy-interfaces are very demanding and they are one of the main inspirations of water science and the study of water resources management at King's. ■





# Exploring a **FAMOUS MEETING**

Dr Clare Pettitt describes the personal, cultural and political journeys that contributed to the writing of her book, *'Dr Livingstone, I Presume?': Missionaries, Journalists, Explorers and Empire.*

One of Livingstone's African servants, Jacob Wainwright, on board the *Malwa*, accompanying Livingstone's coffin back to Southampton from Africa in 1874.



On his African journeys from the 1840s through to the 1870s, the Scottish missionary-explorer David Livingstone often witnessed stomach-churning atrocities committed by slave traders, and he called slavery the ‘open sore of the world’. He was careful to record all he saw in unflinching detail in his journal; sketching, for example, ‘A Slave tied to a tree dead & putrid & greatly eaten by the Hyaenas’.

2007 has seen the bi-centenary of the abolition of slavery: on 25 March 1807 a Parliamentary bill was passed which abolished the slave trade in the British Empire. This marked the beginning of the long road to the eventual abolition of slavery itself within the British Empire via the Act of 1833. Even then, slaves did not gain their final freedom until 1838. Moreover, the success of the British abolitionists did little to stem the flow of the African slave trade, as Livingstone knew well. On 15 July 1871 he witnessed a massacre of the inhabitants of Nyangwe by Arab slavers. When the shooting started terrified people fled into the river where hundreds drowned. Livingstone was running out of paper, but he kept writing on any scraps he could find – determined that this atrocity should be recorded: ‘As I write I hear the loud wails on the left bank over those who are there slain, ignorant of their many friends who are now in the depths of the Lualaba. Oh, let Thy kingdom come!’ Horrified, Livingstone realised that after this he could never accept Arab help again.

### Stranded

This was awkward, because at this point he was pretty much stranded. His medicine chest had been lost in 1867 (an event which he saw as ‘a sentence of death by fever’), his instruments were damaged, and the British government seemed to have forgotten about him. There was nothing for it but to return to the Arab trading town of Ujiji, on the banks of Lake Tanganyika, where he had left supplies in 1869. But when he arrived there on 23 October 1871 he discovered that his goods, worth some £600, had been sold or stolen. Slaving-related violence meant that it was unlikely that the British Consul would be able to get



Dr Clare Pettitt

anything through from Zanzibar for months, ‘[b]ut to wait in beggary was what I never contemplated, and now I felt miserable’, Livingstone recorded. In fact it would only be a matter of days before Stanley arrived to utter his famous line, and to relieve Livingstone. And

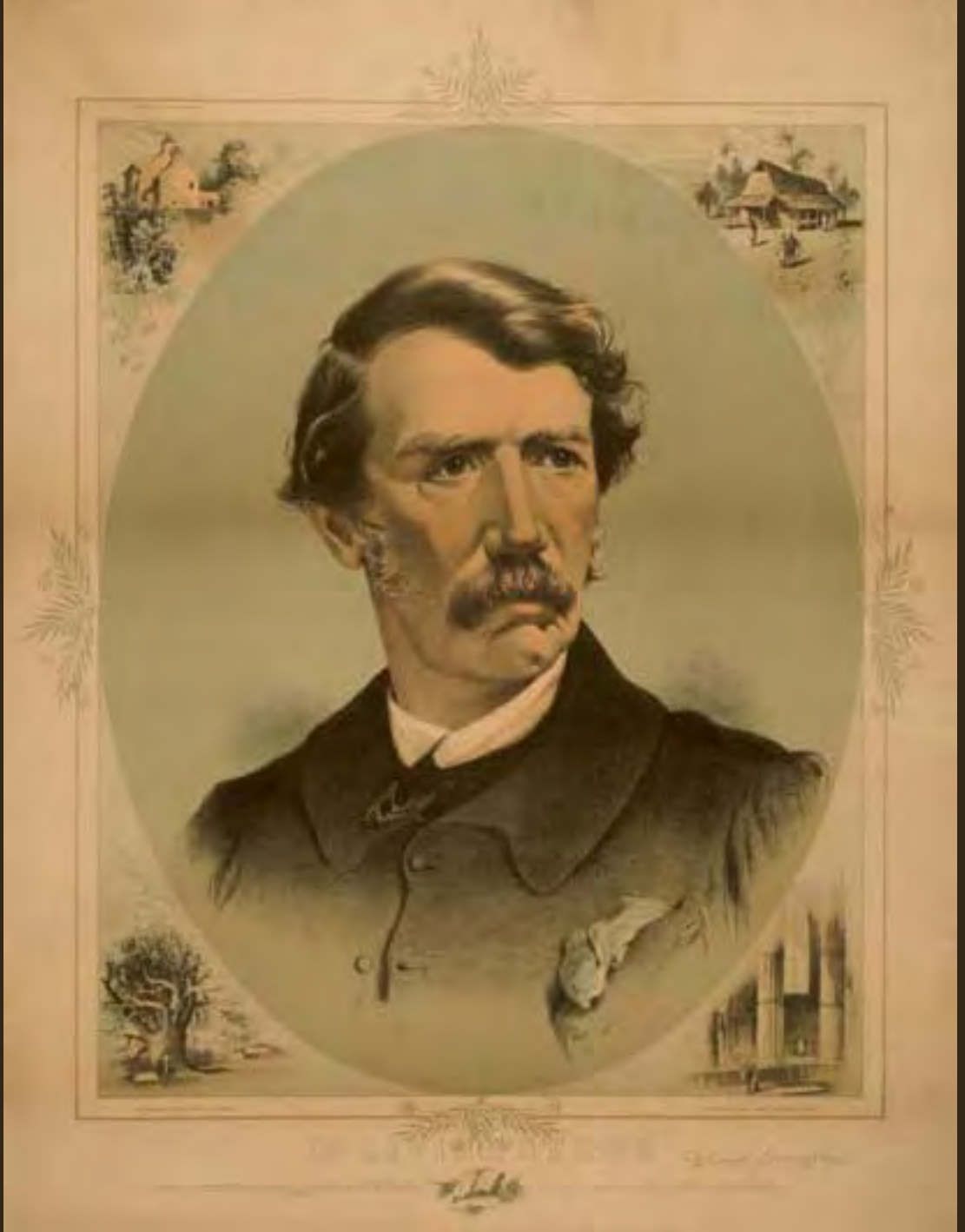
it would be through Stanley that Livingstone would send evidence back to England that would materially help in ending the traffic in African slaves.

The greeting with which Livingstone was hailed by Henry Morton Stanley, reporter for the *New York Herald*, when he stepped out of the jungle and doffed his pith helmet to the explorer, was subsequently to acquire mythic proportions. Without Stanley and his famous ‘Dr Livingstone, I presume?’ we would probably not remember Livingstone. And without Livingstone, Stanley would never have achieved such enduring fame. But do any of us really know what Stanley’s words meant at the time, or what they have come to mean since? My book tells the story of their meeting and what led up to it, and the reactions to it of contemporaries and afterwards. The ‘truth’ is complicated. Livingstone, the crusading anti-slavery missionary, had often co-operated with the slave-traders. He had made only one convert, who later abandoned the Christian faith, and his greatest achievement of exploration – the discovery of the source of the Nile – was in fact a misidentification. A fascinating story of conflict and paradox emerges which takes us into the extraordinary history of British engagement with Africa.

### Creating the myth

As my discipline is English Literature, I was particularly interested in looking at the way in which text, printing technologies and communications networks such as the newly-laid Atlantic cable helped to create the Livingstone and Stanley myth in Britain and America in the nineteenth century. This is the first book to

A chromolithograph of Livingstone from a photograph of Livingstone at the age of 51 taken by Thomas Annan in 1864 on the explorer's last visit to Britain.





**Above:** Stanley meeting Livingstone as depicted in the *Illustrated London News*, 10 August 1872. Stanley certified that this picture was 'as correct as if the scene has been photographed', although it is curious that the flags are unfurling in a strong wind which does not seem to be blowing anything else.

**Right:** Livingstone conducts African villagers in a rousing rendition of 'Onward Christian Soldiers' in the 1939 American film, *Stanley and Livingstone*. The truth was somewhat different: Livingstone made only one convert to Christianity, who later reneged on his conversion.





**A slave convoy, encountered by Livingstone in central Africa. The slaves wore wooden neck yokes and chains and were forced to march for miles.**

MARY EVANS PICTURE LIBRARY



consider the Livingstone/Stanley meeting in 1871 as an early eruption of a kind of global media celebrity with which we are only too familiar today. I have also re-placed the story in its original fraught political context, as Anglo-American relations were under severe strain in the years up to 1871. The handshake between the two men was in fact politically timely: it was a fit symbol of a thawing out of Anglo-American relations after all the bitter feeling between Britain and America over the American Civil War. Despite a position of official neutrality, Britain had materially supported the Confederacy of Southern (slave-holding) States, and the victorious North had demanded financial reparation for this after the war. These claims were settled just as Stanley's rescue of Livingstone hit the news in the summer of 1872. It was perfect: Stanley's report of Livingstone's fierce anti-slavery agenda would not only bolster the Union in the States, but also, more importantly, it would help to wipe out

memories of Britain's support for the South in the Civil War, and re-establish an Anglo-American alliance based on the 'new' values of the American Union – values of democracy and freedom.

So, the story's immense resonance in the nineteenth century, which has kept it current to this day, was intimately tied up with an important shift in Anglo-American culture in the 1870s. Indeed, what looks like a simple story actually resonates with some of the biggest and most complex issues which still affect us all: technology and its transformation of social relations; the growth of celebrity culture; and the birth of an Anglo-American Christian imperialism that still sets the world agenda today.

Researching the book took me to Scotland; to the British Film Institute; to the Royal Geographical Society archives; to Madame Tussaud's; and to special collections and archives all over the country. I wrote the book during a very difficult year in my life when I was being treated for breast cancer. I read Livingstone's vivid descriptions in his journals of his loneliness, and of 'crawling' along in pain, when he was ill in Africa, with great sympathy, as going through chemotherapy sometimes felt weirdly similar. I dedicated the book 'to my good doctor' – my oncologist – and I was more delighted than I can say when the book came out in summer 2007, as there was a time when it looked as if it might never be written, let alone published. So it has been a great satisfaction to me that it has been so well received and so well reviewed.

### **Stanley**

The winner of the race to find Livingstone, Henry Morton Stanley, had been born into poverty in North Wales, grew up in a workhouse, and had emigrated as a teenager to America, working on the plantations of the American South to earn a living until the American Civil War, when he fought on both sides and afterwards became a war reporter. He had been sent on his travels by the enterprising editor of his American newspaper, James Gordon Bennett Junior, who was one of a new generation of newspapermen who saw that news could be created, as well as merely reported.

In his best-selling book, *How I Found Livingstone*, Stanley made much of Bennett's summons to his Paris hotel room and his instruction to an amazed Stanley to 'FIND LIVINGSTONE'. In fact, Bennett seems to have told Stanley to do a grand journalistic tour of the Middle East rather than to find Livingstone. Stanley was to cover the opening of the Suez Canal, then travel up the Nile to write a tourist guide, and go on to visit Jerusalem, Constantinople, the Crimea, the Caspian Sea, Persepolis (where Stanley would sleep in the ruins and carve his initials on a temple pillar), the Euphrates, and India. This represented about a year's worth of travel, reporting on ruins and other non-time-sensitive stories before even starting for Africa.

Reports of Livingstone were various – some said he had been eaten by cannibals, others that he was still alive. It seems that Livingstone was not high on Bennett's news agenda at all, and that it was probably largely Stanley's decision, rather than Bennett's, to risk the trip into Africa on very uncertain information in the hope of producing a scoop. 'I was too far from the telegraph to notify you of such expense or to receive further orders from you', Stanley later explained to Bennett. It is unclear what Stanley would have done had Bennett refused to pay the 8,000 dollars' worth of bills that Stanley had racked up by then.

### Sensation

Stanley's triumph created an enormous sensation in the newspapers in Britain and America. Throughout the summer of 1872 the press was full of the story of the meeting.

After finding him, Stanley carried Livingstone's 'huge Letts's Diary', letters, and geographical reports back to Britain, and out of this material the British press gave particular prominence to Livingstone's graphic exposures of the horrors of the slave trade, including the powerful account of the Nyangwe massacre that precipitated a fundamental change in British policy. 'The movement of the legislature is held to be due to the frightful revelations made by Dr Livingstone', reported the *Illustrated London News* in 1873. The slave market in Zanzibar was shut down by

**'The movement of the legislature is held to be due to the frightful revelations made by Dr Livingstone', reported the *Illustrated London News* in 1873. The slave market in Zanzibar was shut down by the British in June 1873.**

the British in June 1873.

But Livingstone was never to know of his success, for by this time he was dead. It would be more than a year before his mummified remains were buried in Westminster Abbey with all the pomp and circumstance of a state funeral. His African servants carried his body more than a thousand miles across Africa to the coast, so that Livingstone could be returned to his people. When the British officials at Zanzibar protested that it would be easier to bury him there, the Africans insisted the body be returned and refused to be bullied. One of them, Jacob Wainwright, travelled to England with the coffin and attended the funeral as a pall-bearer, and two more – Susi and Chuma – arrived after the funeral in the summer of 1874.

I found it fascinating researching the extraordinary journeys made by Livingstone's African servants around the UK and thinking about what their experience of industrialised urban Britain might have been like. In addition to their African customs and practices, these servants were Muslims, some of whom had been educated in India and had been taught about Christian theology. Their lives were as cosmopolitan as anyone else's in this period, as they travelled between cultures and religions. The Victorian (but surprisingly persistent) idea that Africa existed in some kind of earlier stage of civilisation, and was immune to the 'modern', becomes utterly untenable if we take the trouble to think about the experience of these men. In some ways it could be argued that they were experiencing 'modernisation' at an even more terrifying rate than Anglo-Americans. And before we congratulate ourselves overmuch on the abolition of slavery, anti-slavery organisations today estimate that more than 12 million people are still living and working in contemporary forms of slavery which have been defined and prohibited by international conventions. The main message I would like people to take away from reading my book is that the global history of modernity is much more complicated than we like to think. ■  
*Dr Pettitt's book is published by Profile Press in the UK and by Harvard University Press in the USA.*

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**Above:** The Slave Market at Zanzibar, which was shut down by British intervention in June 1873 after Stanley carried Livingstone's reports of slavery-related violence back to Britain in 1872.

**Left:** Livingstone's 'faithful' (his African servants) carry him on a stretcher in his final illness, near Lake Bangweulu, Zambia. Livingstone refused to stop moving until he was days away from death.



# Taming technology



**King's new Centre for Technology, Law, Ethics and Society (TELOS) is studying the sometimes uneasy fit between new technology and legal and other forms of regulation. REPORT interviewed Professors Roger Brownsword and Karen Yeung about the venture.**





**Professors Roger Brownsword  
and Karen Yeung.**

### **Why is this a good time to be researching the interfaces between science, technology and regulation?**

If we want or expect societies to expand their technological range and sophistication, or if we simply expect communities to become more reliant on technology, then it is important that we get the regulatory environment right for the development and application of new technologies. So, we need to be smarter about regulating emerging technologies, giving them appropriate regulatory support but also setting the right limits to their development and application. As we become more intelligent about regulating technologies, we should not need to keep reinventing the regulatory wheel each time that a new technology emerges. There is also a very good reason – a reason that will resonate strongly with lawyers – for taking up this research agenda at this time. Quite simply, this is that technology promises (or possibly threatens) to change not just the way that lawyers conduct their business but also the way in which regulators operate. If regulators, just like their regulatees, are to become more reliant on technological support, this is a development that we need to keep under review. And it is also quite possible that enhanced technological capabilities will challenge our conceptions of what justice is and what justice requires in the distribution of available benefits or burdens.

### **What kind of new technologies are you looking at?**

Currently, our interest is in four streams of technology: biotechnologies, information and communication technologies, nanotechnologies and neurotechnologies. However, the mission for TELOS is to inquire into whatever technologies emerge and so the list is far from closed.

### **What problems are these new technologies causing for regulators?**

There are five principal challenges. First, as

debates about the regulation of biotechnology (whether concerning GM crops, human genetics, or stem cell research and therapeutic cloning) vividly illustrate, regulators have difficulty in setting standards that are widely accepted as legitimate. Secondly, there are problems about compliance and regulatory effectiveness. For example, how are regulators to prevent the use of the Internet to by-pass local restrictions or to deal with the spread of malware (hostile or intrusive software) or viruses, or to enforce copyright law against file-sharers in peer-to-peer networks? Thirdly, because these technologies develop and move on so rapidly, regulation soon becomes disconnected from its technological target. The Human Fertilisation and Embryology Act 1990, for instance, is less than 20 years old and yet it is seriously out of touch with today's embryology and stem cell science.

Fourthly, there are serious difficulties for regulators at regional and international level – witness, for example, the ongoing European debate about the patentability of stem cells and the recent Biotech Products dispute at the World Trade Organisation between the GM-exporting Americas and Europe. Other examples of regulators struggling to accommodate the local and the universal include the supply of Internet gambling services or on-line hate speech. This might be called the challenge of regulatory cosmopolitanism, meaning the challenge of regulating in a way that respects universal values while, at the same time, respecting legitimate local difference. And finally, new technology may offer regulators a useful instrument for undertaking their regulatory functions, particularly in the monitoring and enforcement of regulatory standards. Yet the use of such technologies may implicate individual rights and constitutional principles, so that these technologies are used appropriately.





### **How are new technologies being deployed as a means of regulation?**

With some four million profiles on the National DNA database and with the wide-spread use of CCTV, tracking and monitoring technology, UK regulators are arguably in the vanguard of a new high-tech approach to criminal justice, security, and social control.

### **Do you foresee other ways in which new technologies will be used to assist regulation?**

In the not too distant future, we might find that the DNA database is scaled up to become a population-wide resource (as well as being joined up with European databases) and biometric identifiers of one kind or another will be introduced. Looking slightly further ahead, there is the prospect of nanomonitoring devices and of neurotechnologies that modify mood and behaviour. The rest is probably science fiction for the moment, but we might imagine a time when our understanding of the interaction between a particular genetic make-up and particular environments tells us how a person is coded, not just for health but also for disposition and behaviour.

### **Do you foresee other ways in which new technologies will cause problems for regulators?**

It is fair to say that regulators already have problems aplenty. However, there are two emerging problems. The first is, how to deal with the use of psychoactive drugs for enhanced performance (such as students who use modafinil or Ritalin to increase their wakefulness and concentration). The second problem is, knowing when and how to regulate nanotechnologies, especially when they converge with other technologies.

### **Can you describe some of your current research projects?**

We recently completed a review on the regulation of biomedical research for the MRC and we are editing a collection of papers arising from the TELOS launch conference in April 2007 which was supported by the Wellcome Trust and

*Modern Law Review* (the leading general law review in the UK). These will be published in 2008. Roger Brownsword has just completed a monograph on *Rights, Regulation and the Technological Revolution* for Oxford University Press and is completing papers on data protection and consent and on the regulation of nanomedicine. Karen Yeung recently completed a book (with Bronwen Morgan) *An Introduction to Law and Regulation* (for Cambridge University Press) and she is now turning her attention to challenges associated with the use of technology as an instrument of regulatory policy implementation.

### **How do traditional legal procedures need to be amended in the light of new technologies?**

If regulators were able to graft traditional law onto the technology in such a way that legal provisions moved flexibly with the technology but, at the same time, gave regulatees sufficient guidance as to their position, then that would be a major advance. However, one of the facts of regulatory life seems to be that the more that legislators strive for precision the more likely it is that the law will be overtaken by technological events. It is commonly said that legislators should employ 'technology neutral' drafting techniques. Sometimes, this works (as with modes of encryption) but it is far from being a panacea.

Having said this, if technology is the regulatory future, what needs urgent consideration is not so much techniques for maintaining legislative



The TELOS launch conference in April 2007 brought together people with many different interests in the regulation of technology. Left to right: Dr Stephen Minger (Director of King's Stem Cell Biology

Laboratory), Justice Michael Kirby (Australian High Court), Professor Karen Yeung (TELOS), Professor Roger Brownsword (TELOS), and Professor Lawrence Lessig (Professor of Law at Stanford University).

connection and sustainability but working out how the values of the Rule of Law might apply to technologically directed control.

**How did TELOS come to be established?**

It was really a coming together of three key ideas: (1) that a law school needs to be thinking about law as one of a number of regulatory instruments; (2) that it is time to join up our thinking about the regulation of particular streams of technology (many so-called law and technology groups focus on ICT); and (3) that it is also time to think about technology as both a regulatory target and a regulatory tool (tapping into the criminological strength of the Law School at King's).

**Is TELOS unique?**

In the UK, there is certainly no other cluster that has such a research remit. However, there are groups elsewhere in Europe – notably, the Tilburg

Institute for Law and Technology (TILT) in the Netherlands – that are pretty similar in their aspirations; and we can expect specialist law and technology units to broaden their research horizons so that they move closer to the TELOS model. In fact, the Intellectual Property and Information Technology Centre at the University of Edinburgh, which is now entering the second phase of its funding from the Arts and Humanities Research Council, has broadened its remit to include technology more generally, and TELOS will be collaborating with it on a project that studies the regulation of biotechnology in the southern hemisphere (particularly in Argentina and South Africa).

**What are your plans for developing TELOS?**

Next year, Roger Brownsword will make regular visits to TILT as their visiting scholar for the year. Roger and Han Somsen (the Director of TILT) will act as general editors for a new journal to be

**MOBILE PHONE PAIN – NOT CAUSED BY MOBILES**

**The discomfort sometimes reported by people who use mobile phones is likely to be caused by their own expectations, research by an outstanding young King's academic, Dr James Rubin, has shown.**

Dr Rubin, lecturer in Psychological Medicine at the Institute of Psychiatry at King's, devised a simple experiment to show that electro-sensitivity – the discomfort reported by people in connection with weak electromagnetic fields – is caused more by psychological factors than by electrical ones. Dr Rubin's research involved exposing people who reported sensitivity to mobile phone signals to three exposure conditions: one with a pulsing mobile phone signal, one

with a non-pulsing signal and one with no signal. The fact that volunteers reported severe symptoms in all three cases indicated that there was a psychological explanation for the phenomenon.

Dr Rubin comments: 'If you are anxious about something, such as the signals given off by a mobile phone, then that anxiety can cause real, physical symptoms. And if you expect to develop symptoms, you monitor yourself more closely, and

those expectations can turn into a self-fulfilling prophecy.'

**Reverse placebo**

These findings – demonstrating that innocuous exposures can produce a 'reverse placebo effect' – received widespread media coverage, and Dr Rubin was short-listed for the 'Young Researcher of the Year' Award in the *Times Higher Awards* for 2006. He is now extending his work to test whether a simple explanation of his results has beneficial effects for his original volunteers.

Also currently under scrutiny by Dr Rubin's team is the new 'Airwave' radio system that the police have been rolling out for all their officers.



launched in 2009 and, in addition to working on the development of the journal, it is hoped that TELOS, in conjunction with TILT, can begin to form a worldwide network of cognate centres.

At the moment TELOS has only two core staff plus a number of PhD students. To do justice to its research agenda, it needs a critical mass of at least half a dozen researchers. Ideally, the cluster could be brought up to strength with one full-time lecturer appointment and the best doctoral students brought through and retained with external research contract funding. It would be wonderful if a philanthropist thought 'This is a great idea!' and wanted to support us!

#### **Does your work in TELOS have any impact on your teaching?**

Yes. For the past three years, Roger Brownsword

has taught a London University inter-collegiate LLM module on 'Law, technology and global governance' and an undergraduate Jurisprudence option on 'Law and the technologies of the 21st century'. In 2007-8, for the first time, there will be a King's LLM and both of us will be offering a number of options that draw on the work of TELOS.

#### **Does TELOS have links with any other parts of the College outside Law?**

Yes, TELOS has informal links (particularly through Geneva Richardson – see page 50) with the Institute of Psychiatry at King's, with the Centre for Biomedicine & Society, and with Computer Science. We are acutely aware, however, that our research in TELOS intersects with the work of many other researchers in the College and we are keen to extend our links.

Some officers have reported experiencing adverse effects when they use their new radios. A double-blind experiment devised by his PhD student, Rosa Nieto, is testing whether it is the signals produced by the handsets that are responsible for these effects.

#### **Terrorism**

The other side of Dr Rubin's work is the psychological impact of terrorism, to examine likely public reactions to chemical, biological and radiological terrorism. A study of responses to the London bombings published in the *British Journal of Psychiatry* in April 2007 showed that levels of anxiety in the

population were much reduced seven months after the event, and that it is very difficult to predict who from the general population will remain distressed following a terrorist attack.

He has recently published another study in the *British Medical Journal* assessing how the London public reacted to the poisoning with polonium 210 of former Russian Federation security colonel, Alexander Litvinenko. The research found that people who were caught up in the incident (the customers in the Itsu sushi bar and in the Millennium Hotel) were largely satisfied with the way they had been handled by the UK's Health

Protection Agency. There was still room for improvement, however, particularly in the way information was given to people about the risks they faced. The results will be used by the Health Protection Agency to improve their response should a similar incident happen again. ■








Tackling the





Defensive lymphocytes, amassing in recipient spleen and lymph nodes, are targets for preventing transplant rejection.

Professor Steven Sacks describes how King's is leading the challenge to tackle the problems of transplant medicine.

# TRANSPLANT Crisis



**T**he UK is facing a transplant crisis. More than 6,000 patients are waiting for new organs, and this number continues to grow. Meanwhile, up to one-third of patients die while waiting for heart and liver transplants. The average lifespan of a new organ is less than 10 years, and recipients face increased risk of cancer, heart disease and infection because of their continuous use of anti-rejection drugs.

For transplantation therapy to achieve greater success, we need to find alternative sources of donor tissues and cells that lend themselves to therapy for a larger number of conditions, such as kidney and liver failure, arthritis, diabetes and tooth decay. We also need to find a way of ensuring that the replacement tissue is accepted without requiring lifelong drugs to block the immune system.

The new Medical Research Council (MRC) Centre for Transplantation at King's is the first of its kind in the UK and in Europe. It brings together a wide range of expertise in different scientific and clinical disciplines to tackle the problems of transplant organ shortage and longevity. The Centre's research will apply an extensive knowledge of human immunology, stem cell biology, genomics and imaging to develop new areas that will benefit human health. It will play a pivotal role in training and education and will work closely, through Professor Genevra Richardson, with the College's Centre for Medical Law & Ethics on the regulation and ethics of transplantation research.

### **Anti-inflammatory therapy**

The body's inflammatory and immune systems present formidable barriers to transplantation. By identifying key proteins that trigger the inflammatory response in transplant organs, we hope to lower this barrier and increase the number of successful transplants. A key perpetrator is 'complement': a set of proteins whose explosive action has been likened to a waterfall or cascade – helpful in the defence against bacteria and viruses, but destructive when it is activated by transplant surgery. Working

with the pharmaceutical industry, we have evolved a method for coating the inner surface of donor kidneys with a protective biological layer made from a substance which is a natural regulator of these proteins. This resists complement attack and increases the number of donor organs eligible for transplantation.

Dr Richard Smith, a protein chemist who co-invented the technology, is now based at King's, where he is setting up a protein therapeutics laboratory. He has already demonstrated that this technology is safe for use in man, and the first task for his new laboratory will be to expand the technology to allow large-scale clinical trials. He is also working with Dr Tony Dorling, a Centre

**Kidney filtration units in the transplant kidney are essential for maintaining health.**

MI WALKER, WELLCOME IMAGES





investigator based at Imperial College London, on ways of preventing blood clots from forming in high-risk transplants.

### Cell therapies

The greatest challenge in transplantation is to overcome the army of powerful immune cells called lymphocytes. Specific lymphocytes seek out and destroy transplant tissue in all but the most closely-matched transplants, such as those between identical twins. While this class of lymphocyte is the main target for drugs which lower the destructive element of the immune system, it is now apparent that another type of lymphocyte should actually be encouraged in transplantation. So-called 'regulatory lymphocytes' have properties which enable them to keep the destructive elements in check. Expanding the population of regulatory lymphocytes is a central part of the

## KING'S HIGH FIVE



GREG FUNNELL

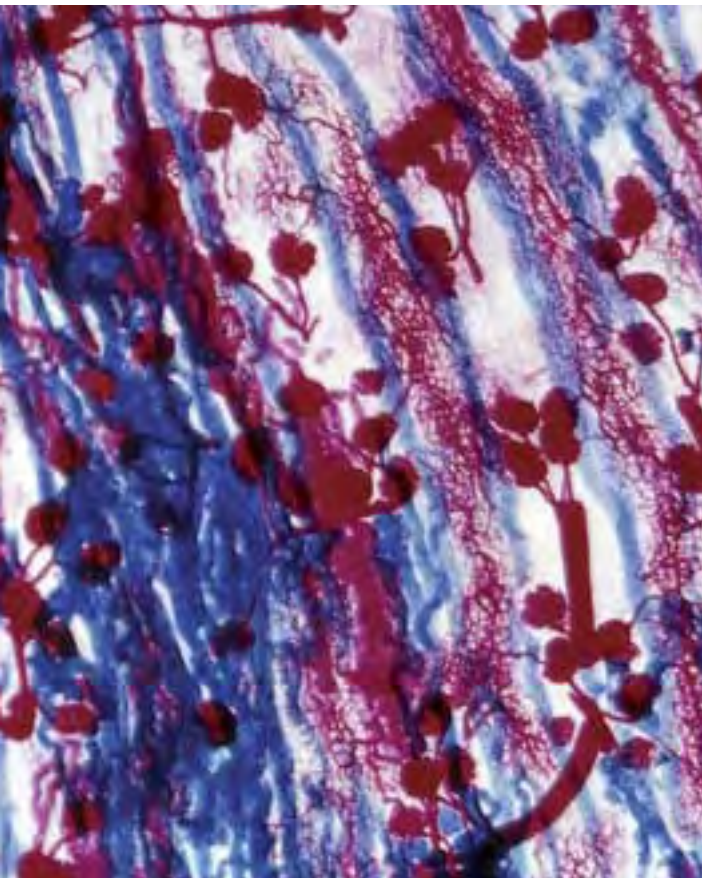
The award to King's of a new MRC Centre for Transplantation, to be directed by **Professor Steven Sacks**, was announced in March 2007. This brings the total of these prestigious research Centres at King's to five: more than at any other university, and more than a quarter of all these centres in the UK. The other MRC centres at King's are:

- Centre for Social, Genetic & Developmental Psychiatry (led by Professor Peter McGuffin)
- Centre for Developmental Neurobiology (led by Professor Andrew Lumsden FRS)
- MRC-Asthma UK Centre in Allergic Mechanisms of Asthma (led by Professor Tak Lee of King's and Professor Tim Williams of Imperial College London)
- Centre for Neurodegenerative Research (led by Professor Brian Anderton).

strategy employed by the team led by Professor Robert Lechler, which is seeking more specific, less harmful ways of controlling the immune response. The perfect state is a balance where the immune system ignores the transplant but retains the ability to fight off dangerous organisms. This kind of tolerance is the ultimate goal of transplant research, and the Centre will be using cell-culture methods to expand the number of regulatory lymphocytes to be given back to patients, with the aim of promoting long-term transplant acceptance without using immuno-suppressive drugs.

### Imaging

Conventional tests for monitoring the activities of the body's inflammatory and immune systems rely on blood sampling, but this tells us little about what is happening in the new organ. The Centre is devising ways to visualise components of the inflammatory and immune cascades by whole-organ imaging. For this, we are constructing soluble protein tags with the capacity to highlight transplant organs damaged by inflammation. We are also developing ways to monitor immune-cell traffic passing through the transplant so that we can build a picture of the more destructive or protective elements entering the transplant. The



## BLUEPRINT

The MRC Centre for Transplantation came into being when researchers at two King's campuses – Guy's and Denmark Hill – examined their strengths in basic and clinical science and fashioned a blueprint for how to combine these skills and translate them into patient benefit. The call from the Medical Research Council for the establishment of this kind of 'translational' centre provided King's with the opportunity to gain strategic support from the MRC, giving the Centre impetus and allowing it to combine its skills more effectively. One of the Centre's strengths, besides the expertise in basic immunology and transplantation biology at King's, is the large number of transplant patients who are looked after by our partner NHS trusts: the Guy's & St Thomas' NHS Foundation Trust and the King's College Hospital NHS Foundation Trust. The kidney, liver and bone marrow services in these trusts carry out some 450 transplants a year, giving rise to one of the largest groups of transplant patients in Europe.

Another decisive factor in the MRC's choice of King's was the breadth of general research skills that the College has brought together: particularly in genetics, imaging sciences and stem cell biology. These cross-cutting disciplines provided the glue needed to enable a unified plan, where significant progress in biomedicine could be made. Strengths in the College's Centre for Medical Law & Ethics also help us to provide an



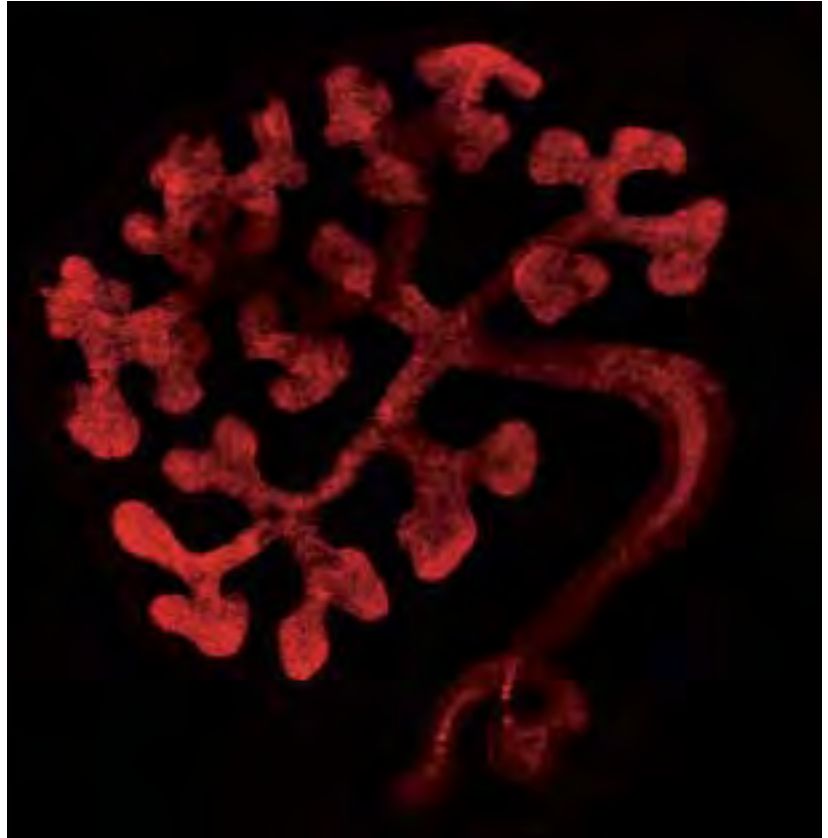
**MRI scan of a transplanted kidney. At the centre right are the blood vessels serving the transplanted kidney.**

innovative educational programme with an emphasis on the regulation and ethics of transplant research and its potential impact on society. This integrated vision for health, education and research translation earned the Centre maximum points in the MRC's scoring system.

Structural support offered through the MRC Centre will make it easier for investigators to collaborate. Dedicated posts in protein engineering, statistics, bioinformatics, complex surgery and lymphocyte culture will help existing programmes to reinforce each other and bring new research and teaching capabilities to the Centre.

A central administrative team will ensure effective communication and run the Centre's business affairs as well as keeping track of milestones. Researchers will gain access to new facilities for manipulating proteins and cells that underpin human therapeutic studies and imaging procedures. Six four-year PhD studentships will be awarded to joint projects that link the main research programmes of the Centre and consequently enhance the way its research can be translated into treatment for patients.

**Confocal image of a developing mouse kidney grown in culture.**



LYDIA MICHAEL AND LINDA SHARP, WELLCOME IMAGES

Centre has, with guidance from Professor Reza Razawi, Head of the Division of Imaging Sciences at King's, put together a multidisciplinary team which has expertise in imaging physics and chemistry, protein engineering and immunobiology, and the ability to adapt these methods for clinical uses.

### **Biomarkers**

Aggressive behaviour by a patient's immune system equates with a poor long-term outcome in transplantation. Genetic testing will in future be able to predict the aggressiveness of a patient's immune system which might lead to transplant failure. For example, assessing small variations in the genetic makeup of our complement proteins has defined biological indicators that correlate strongly with kidney transplant failure within 10 years. In the Centre, we will assess the significance of these findings more comprehensively, exploring whether it is feasible to adjust the treatment of

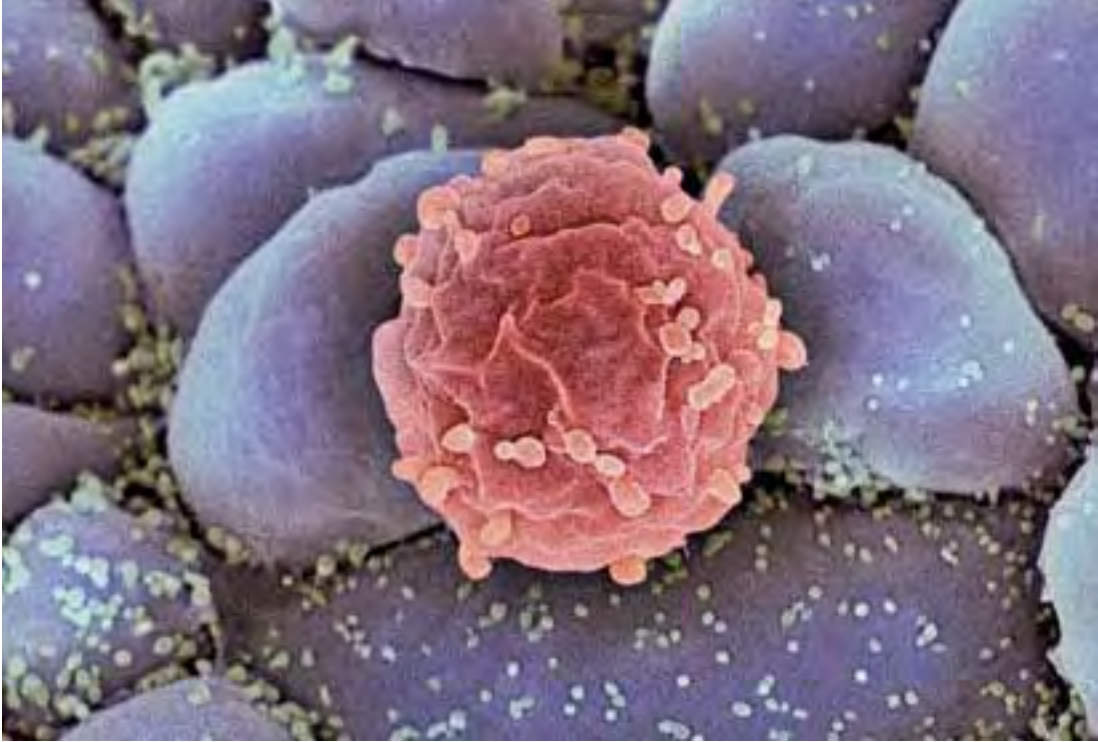
individual patients or patient groups according to their genetic risk. This may not only make it possible to avoid rejection in high risk groups, but could also spare those at lower risk from the dangers of excessive treatment. In collaboration with Professor Ellen Solomon, Head of the King's College Division of Genetics & Molecular Medicine, and colleagues in Medical & Molecular Genetics at Guy's Hospital, transplant teams working through the Centre will be equipped to scan the human genome, seeking new biological markers that may help to manage their patients.

### **Basic immunology**

The Centre's ideology is to support basic and applied immunology research under one banner, so that new knowledge about the workings of the immune system can drive the development of clinical diagnosis and treatment. To this end, a broad programme of studies directed by the



### Foetal blood stem cells ready for transplantation.



JIM DOWDALLS / SCIENCE PHOTO LIBRARY

College's Head of the Department of Immunobiology, Professor Adrian Hayday, will support extensive patient-orientated research. A prime example is Professor Hayday's work identifying new molecules on the surface of injured cells. It is likely that such stress-induced molecules will render transplant organs more vulnerable to attack by 'natural killer' cells, which specialise in the elimination of cancer cells and infected cells and thus are normally protective. However the presence of stress-induced proteins on a foreign organ could mark it out as a target for natural killer cells and could therefore lead to rejection. The juxtaposition of basic and clinical sciences in the MRC Centre creates new opportunities to interpret the relevance of these findings in man and identify new potential targets for therapy. Other basic observations arising from the Immunobiology research programme relate to how and when lymphocytes develop their capacity for regulation of the immune system. Such information is vital for the Centre's aim to exploit regulatory lymphocytes in cell therapies that prevent rejection.

## CLINICAL ALLIANCE

The following clinical investigators are involved in the work of the Centre:

- **Liver transplantation**, led by Professor Nigel Heaton (at King's College Hospital) and Professor Georgina Vergani (at the Denmark Hill Campus of King's College London);
- **Kidney and pancreas transplantation**, led by Mr Geoff Koffman (at Guy's & St Thomas' NHS Foundation Trust);
- **Bone marrow replacement**, led by Professor Ghulam Mufti (at the Denmark Hill Campus of King's College London);
- **Liver cell replacement**, led by Professor Anil Dhawan (at the Denmark Hill Campus of King's College London);
- **Islet transplantation**, led by Professor Stephanie Amiel (at the Denmark Hill Campus of King's College London).

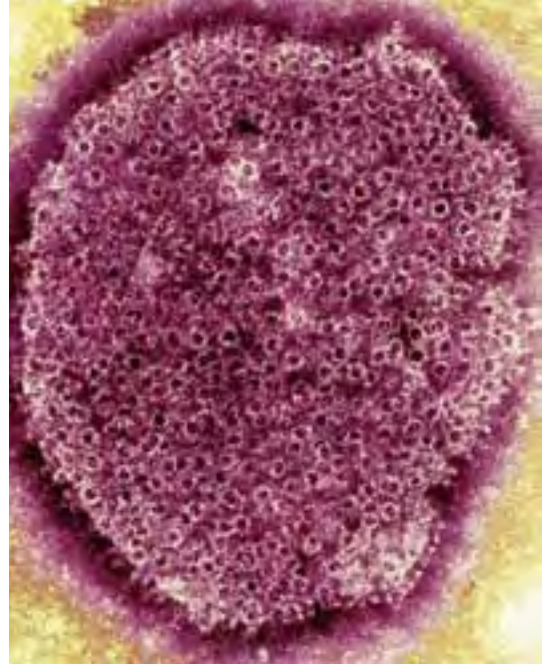
### Exploitation of stem cells

The advent of stem cell therapy makes it possible to contemplate tissue replacement and repair on a wider scale, in the treatment of conditions such as arthritis and diabetes, as well as organ transplantation. A major example of this research at King's is the pioneering work on tooth replacement led by Professor Paul Sharpe, Head of the Department of Craniofacial Development in the College's Dental Institute (one of the world's leading and largest centres for dental research). Given his finding that adult teeth will grow perfectly from carefully nurtured stem cells, a crucial question is whether the adult immune system will tolerate off-the-shelf stem cells from unrelated donors. The MRC Centre, with its wealth of immunology expertise and close proximity to the King's Dental Institute, will carry out an in-depth immunological appraisal of the technique. This will indicate whether rejection is an issue and, if so, what steps are necessary to permit successful tooth regeneration. The 'humanised' model being developed for skin-disease research by Professor Frank Nestle at the St John's Institute of Dermatology at King's will provide the Centre with a powerful tool to test whether potential stem cell therapies are compatible with human immune systems. This technology will provide a stepping-stone between pre-clinical studies and their application to the treatment of patients.

### Looking outwards

The integrated platform for research and development created by the Centre has the power to influence clinical treatments within the next five to 10 years. Progress will depend on an intimate relationship between laboratory and clinical scientists, which extends beyond King's. The UK has 42 transplant centres and at least eight basic research programmes in transplantation, with little relationship between the size of the services and research activity. The King's MRC Centre will provide nationwide access to its training and research programmes, and so will act as a catalyst for wider collaboration. Indeed, the Centre will become part of a global centre of excellence in

**Holes punched by the complement system of anti-bacterial defence cause self-injury to a host red blood cell.**



R. DOURMASHKIN, WELLCOME IMAGES

transplantation which will bond the new biomedical research centres that have formed under the umbrella of the National Institute for Health Research. The large cohorts and wide ethnic diversity of patients offered through such a national network will provide benefits in terms of patient numbers and ethnic diversity for exploring novel therapies and predictive markers in this relatively small but important field.

The centre has already forged links with a number of European and US investigators, especially with 'tolerance networks' whose focus is to understand the long-term, maintenance-free acceptance of transplants. The valuable information provided by this type of successful transplant, which may hold vital clues to overcoming immune barriers, will be easier to identify through a multicentre organisation in the UK. A leading expert from Harvard, Professor Terry Strom, will spend several weeks a year working at the MRC Centre, and this union between two of the largest transplant centres, in Boston and London, brings new opportunities to share ideas and resources, enhancing the prospects for successful translation of research into treatment.

## A POUND OF FLESH?

**Professor Genevra Richardson, of the King's School of Law and Centre of Medical Law & Ethics, discusses the ethics of transplantation.**

Before the advent of modern medicine, our predecessors would never have imagined that an essential bodily organ could be transplanted from one individual to another. But even if it still makes some of us slightly uneasy we have now got used to the idea. We know that hearts, livers, lungs and kidneys can all be successfully transplanted. As advanced and sophisticated as this technology undoubtedly is, there are still serious problems to be overcome and the King's MRC Centre will be at the forefront of the drive to find solutions.

Not least among these problems is that of organ scarcity, the severe mismatch between supply and demand, one possible solution for which might lie in the active encouragement of 'donations'. But the gifting of tissues and organs between individuals raises fundamental ethical issues against which any policy designed to increase the number of available organs must be judged. In the Law School, and particularly within the Centre of Medical Law & Ethics, we are studying these ethical and regulatory issues and look forward to the opportunities that the creation of the MRC Centre will provide for collaboration with colleagues in the Medical School.

### **Alder Hey**

Organ and tissue donation may occur post mortem (after death) or inter vivos (between living people). And, although the latter may raise the most sensitive issues, post mortem donation is not without its own ethical and regulatory dilemmas, as the Alder Hey organ retention episode so starkly illustrated. At Alder Hey Hospital in Liverpool in 1999 the public became concerned that children's organs were being removed after death without proper consent and possibly for trivial purposes. The subsequent Human Tissue Act, reflecting our obligations under the European Human Tissues and Cells Directive, has significantly formalised the relevant consent requirements and accompanying procedures. While in many respects these additional safeguards are welcome, there is an argument that they have gone too far and have led to a reduction in available organs, thus exacerbating the problems of scarcity. There is certainly a debate to be had here. What, for example, would be the clinical, cultural and ethical implications of a system in which we had actively to opt out of donating our organs after death rather than expressly to opt in?

Organ and tissue donations by living individuals typically occur between close relatives and no money changes hands. In legal and ethical terms these are regarded as altruistic donations and are permitted, even encouraged. In clinical terms they can be especially valuable because of the likelihood

of a good tissue match, particularly between siblings. In direct contrast to these altruistic donations, the law prohibits the sale of organs or other body parts: it is illegal to sell your kidney. Effectively the state intervenes in order to protect would-be donors from taking serious risks with their health for commercial motives. Intuitively this distinction seems right to many of us and appears to accord with our commonly shared values. While we applaud the altruism of the sibling donor, we are reluctant to encourage an open market in body parts.

But the risks to the donor's health are identical in both cases and the moral and social pressure on the sibling to donate altruistically must be almost overwhelming. To them their altruism may not seem entirely voluntary. In addition the commercial donor may be motivated not by greed but by the desire to provide for a sick child or an elderly relative, a position not so very different from that of their altruistic counterpart. So it may be unwise to rely simply on our intuitions here. We need to investigate further the distinctions that are being made, the case for change and the implications for individuals and society as a whole of any changes. Once again the opportunity to collaborate with our colleagues in the MRC Centre in teasing out these issues will be immensely valuable.



**While we applaud the altruism of the sibling donor, we are reluctant to encourage an open market in body parts. But the risks to the donor's health are identical in both cases and the moral and social pressure on the sibling to donate altruistically must be almost overwhelming.**

### **Dilemmas**

My involvement with the regulation of stem cell research, through my role on the Council of the MRC and on the Steering Committee of the Stem Cell Bank, has forced me to confront some of these dilemmas directly. We are all now aware of the hope that advances in stem cell science will bypass the problems of scarcity by enabling the creation of organs specifically for transplant. And more particularly that it will be possible to create these organs from the patient's own genetic material, thus reducing the serious problem of tissue rejection and all that flows from it. But this ultimate goal is still a long way off and much intense research has to be done before it can be realised.

This research depends on the availability of donated human tissue – adult, foetal and embryonic – each of which brings its own ethical dilemmas. More particularly the work required to develop the ability to create tissue-matched organs demands the use of eggs. In the case of human eggs these are in very short supply. The process of acquiring human eggs from live donors is invasive and potentially risky. Women undergoing IVF, for whom this procedure will be part of their treatment, are sometimes offered the opportunity to donate 'surplus' eggs either to other women or for research. But to date this has done little to resolve the scarcity. One possible solution is being sought through the device of 'egg sharing'. It is now accepted that IVF patients providing eggs for other women may receive a contribution towards the cost of their treatment. And recently the HFEA has agreed to license a research project that would offer

the same financial arrangements to women who agreed to give some of their eggs to research.

Insofar as this can be seen as the use of financial inducements to encourage women to offer their biological material for research, it is highly controversial. Such a use of inducements would conflict with widely accepted international norms and its acceptance by the UK in the context of stem cell research is seen as reflecting a very liberal approach. On the other hand it can be argued that women who agree to give their eggs in return for a contribution to the costs of their treatment are attracting no greater risks to their health than those they are already prepared to accept in the course of their desired treatment, and they should be free to do so if they wish. Whichever view is ultimately preferred, it is evident that this debate has opened up the whole question of the role of inducements in relation to the donation of tissues and organs for both treatment and research. I greatly value the opportunity provided by the MRC Centre to take this debate forward in a genuinely multidisciplinary setting.

As a postscript it is important to note that there is another possible way around the scarcity of human eggs for stem cell research: that is, the use of inter-species embryos – and again King's is in the forefront, through the work of the College's Stem Cell Biology Laboratory, which grew the UK's first human embryonic stem cell line in 2004. The signs are now encouraging that the team will be given a licence by the HFEA to conduct this vital research. ■



**Genevra Richardson was the recipient of two major honours in 2007: a CBE and a fellowship of the British Academy (see page 9).**

**In 2004 she received the unusual distinction for a lawyer of being elected an honorary fellow of the Royal College of Psychiatrists. She is also a trustee of the Nuffield Foundation and a member of the Council of the MRC. She came to King's in 2005 after teaching at Queen Mary, University of London, where she was Dean of the Law Faculty from 1996 to 1999.**

# Extending **MEDICAL SUCCESS**

**The first three graduates from King's ground-breaking Extended Medical Degree Programme were awarded their degrees in June, receiving a special message of congratulations from Prime Minister Gordon Brown. Dr Pamela Garlick, Course Director, reflects upon the first six years of the Programme at King's.**







**Graduates Dr Stella Adesoye, Dr Anya Omunnakwe and Dr Linda Onyema at their degree ceremony at Southwark Cathedral in June 2007.**





**T**he Extended Medical Degree Programme (EMDP) began in 2001, when ten extra student places were allocated by the Higher Education Funding Council of England to

King's in order to widen participation in the College's medical degree by students from specific 'deprived' London boroughs. The annual intake of these students is now 50 per year, in addition to the 360 places a year on the College's conventional medical course.

The Extended Programme takes six years rather than five. During their first three years, the EMDP students attend lectures, tutorials, dissections and practicals with the 'conventional' students, but they cover the material at a different rate (55 per cent, 65 per cent and 80 per cent of the conventional curriculum in each of their first three years respectively). The extra available time is used for tutorials and for student-led work. The three predominantly clinical years are then completed in the standard time.

### Admissions

'A level grades are a good predictor of success at medical school, but they are not perfect', Dr Garlick says. 'For the applicants we are trying to reach through our widening participation

initiative, their poor secondary schooling has not allowed them to achieve grades which reflect their inherent ability, so we need to find a way of assessing their potential by means other than exam grades.

'All students for the EMDP must have attended a state school or college in one of the 'eligible' Inner London boroughs: boroughs with high rates of multiple deprivation and/or low school performance at GCSE. Some schools had exam rates as much as 70 per cent below the national average. We use the mental agility test (MAT) to assess the innate cognitive ability of candidates from these schools. Candidates with a high MAT score are invited for a 30-minute, semi-structured interview. This is time-consuming, but it allows us to make a fairer assessment of applicants who have often not had any practice in attending interviews.

'Our standard offer to EMDP applicants is grades CCC at A level, compared with the standard offer of AAB grades for the conventional King's five-year medical course. We sometimes accept applicants with even lower grades if they have performed exceptionally well in the interview or the MAT. The lower offer reflects the generally low achievement levels of the schools or colleges that they attend, rather than the potential of the individual candidates.'

**EMDP students, on average, are very motivated, and the academics who teach them often comment on their enthusiasm and their ability to ‘think outside the box’. They do, however, need extra academic, pastoral and cultural support in order to reach their full potential.**

## REFLECTING DIVERSITY

‘We know that about three-quarters of our conventional MBBS students at King’s are from professional, middle-class families’, Dr Garlick explains. ‘This compares to about one in three of the EMDP students. Many of the EMDP students with a professional or managerial background have a Black African heritage and a mother heading the family who has entered higher education as a mature student to study nursing or social work. Many of the students classified as having parents working in semi-routine and routine jobs are from South Asian families. Their mothers seldom work outside the home and their fathers are, for example, cab drivers, kitchen porters and machinists. These are generalisations, of course, but they help to show the complex ways in which class and ethnicity are linked.

‘White British and Black Caribbean groups are under-represented amongst the EMDP students. The research we have



**Dr Pamela Garlick**

done suggests that fear of failure or ridicule, and expectations of class prejudice, prevent some students from applying. Other young people do not value the “status” associated with being a doctor: they want to achieve a modest level of financial security and stability, in the short term, without going to university.

‘Most of the EMDP students are the first in their family to go to university and sometimes the first pupils from their schools to study medicine. In order to support them we’ve developed a number of activities including, very importantly, an induction week, which is held before the other students arrive. We use this time to convince them that we are interested in them as individuals and that we believe in

their potential; we feel that this helps the students to become effective learners in what appears to many of them at first to be an alien environment. As the number of EMDP students has grown over the years to the point where they constitute almost one in ten of the year group, these students have grown in confidence and now they no longer feel that they were “different from” or “not as bright as” the conventional students.

‘The EMDP students’ exam results compare quite well with those of the rest of their year groups. EMDP students are now gaining Merit Awards in some exams, for coming in the top 15 per cent. Their retention rate is 90 per cent, compared with 97 per cent for students on the conventional programme, and 83 per cent for UK students in general, in the year 2000. EMDP students, on average, are very motivated, and the academics who teach them often comment on their enthusiasm and their ability to “think outside the box”. They do, however, need extra academic, pastoral and cultural support in order to reach their full potential.’

## A FAMILY AFFAIR

**Dr Linda Onyema**, one of the first three graduates from the extended degree course, has established a family tradition. Her brother **Chris Onyema** has just completed the third year of the course, and another brother, **Michael**, started in 2007. Linda won Damilola Taylor prizes for academic achievement in her first and third years, and Chris won the same prize in his second year.

**Isaac Shepherd-Prince was interviewed by BBC Radio 4 in June. ‘I’m from South-East London, and you don’t really hear of many medical students, let alone doctors, coming from those kinds of areas, I’m just glad to have this opportunity.’ Although Isaac got poor grades in his A levels, he is now achieving marks in the top 10 to 15 per cent for the whole of his year. ‘I can’t quite believe it myself, but courses like this that let you get your foot in the door and give you time to mature show you that there’s a new breed of doctors for tomorrow. I think that’s important, because you need to have people in the healthcare professions that reflect the communities that they’re working in.’**

## (RE)ENCOUNTERING NIGERIA

**Two students on the Extended Medical Degree Programme travelled to Nigeria in summer 2007 to help provide health education and encouragement for local youths through the Damilola Taylor Foundation. Oluwafunke Mohammed and Ibironke Bisiriyu, who are both of Nigerian origin, describe their experiences.**

The Damilola Taylor Foundation in Nigeria is a sister body of the Trust founded in London after the death of 10-year-old Damilola Taylor in Peckham in 2000. Here, the primary aims of the Trust are to improve the lives of under-privileged children in London by preventing the cycle that leads to a life of crime and to encourage projects that lead to the integration of these youths into society. The Trust supports the aims of the Extended Medical Degree Programme at King's and sponsors a prize-giving ceremony for high-achieving students at the end of each academic year. In Nigeria the sister Trust uses football as a means of bringing together youths who might otherwise engage in antisocial behaviour. Whilst being formally trained and coached, they receive ongoing moral instruction, health education and encouragement. As medical students, we were ideal candidates to assist in teaching health-related topics such as first aid, HIV/AIDS awareness and nutrition.

After months of planning we arrived in Lagos, and were welcomed by the scorching heat.

This was the first year of this programme so we were naturally apprehensive and unsure of the challenges we might face and the potential value of our contribution. The plan was to meet with the youths three times a week at the primary site of the foundation in Ebutte Metta, Lagos. Our first meeting was with the 16-19 year olds. We were greeted by 40 curious faces and we immediately caught their attention as we had a resuscitation dummy which had been kindly donated to us. The younger age groups of eight- to 15-year-olds were more reticent at first but became more confident after the ice-breaking session and began to participate actively.

Although the children we worked with were from very disadvantaged backgrounds and had varying educational experiences, most were quite knowledgeable about a lot of health-related issues. It was immediately apparent that they were not ignorant of topics like HIV/AIDS and, as with most young people, they were inquisitive and keen to explore ideas on the varying modes of HIV transmission. We were asked how long it would take for a virus to become deactivated outside the human body and whether mosquito bites or sharing razors used by barbers could aid viral transmission. These questions and many more got us thinking and actually facilitated the consolidation of our own knowledge. Most of the youths were aspiring footballers, and were therefore very keen on topics such as good nutrition and treatments for football-related injuries.

As we are both Nigerian in origin we had no real problems with cultural adaptation. However, living in London and studying medicine has





**We were asked how long it would take for the AIDS virus to become deactivated outside the human body and whether mosquito bites or sharing razors used by barbers could aid viral transmission.**



**The King's students taught Nigerian youths how to perform cardio-pulmonary resuscitation.**

definitely had an impact on the way we would approach certain situations. We were made aware of things we had never thought about or conceived would be a problem. For example, they explained to us that the unstable state of affairs in some regions of the country would make them reluctant to offer help to a stranger found unconscious in the street, as a good Samaritan could easily be accused of being responsible if found by officials or even members of the public next to the unconscious person. Before our trip we did some fundraising in order to purchase first aid and football equipment, t-shirts and pens to take with us. Although these things seemed insignificant to us, they were graciously received and appreciated. This alone helped us put into perspective how lucky we are and how much we take for granted.

As part of our trip, the Foundation in Nigeria helped us to organise visits to a nearby local government hospital. This was very useful as it gave us a glimpse of the current state of healthcare in Nigeria and we were also able to make comparisons with the systems that we were familiar with in the UK. Admittedly we had prepared ourselves for the worst, but we quickly discovered that media images and publications were not always the most accurate depiction of such situations. Despite constraints like lack of funding and equipment, great efforts were being made to provide the best possible standard of healthcare. This is not to say that the hospitals were in any way perfect and the relatively high cost

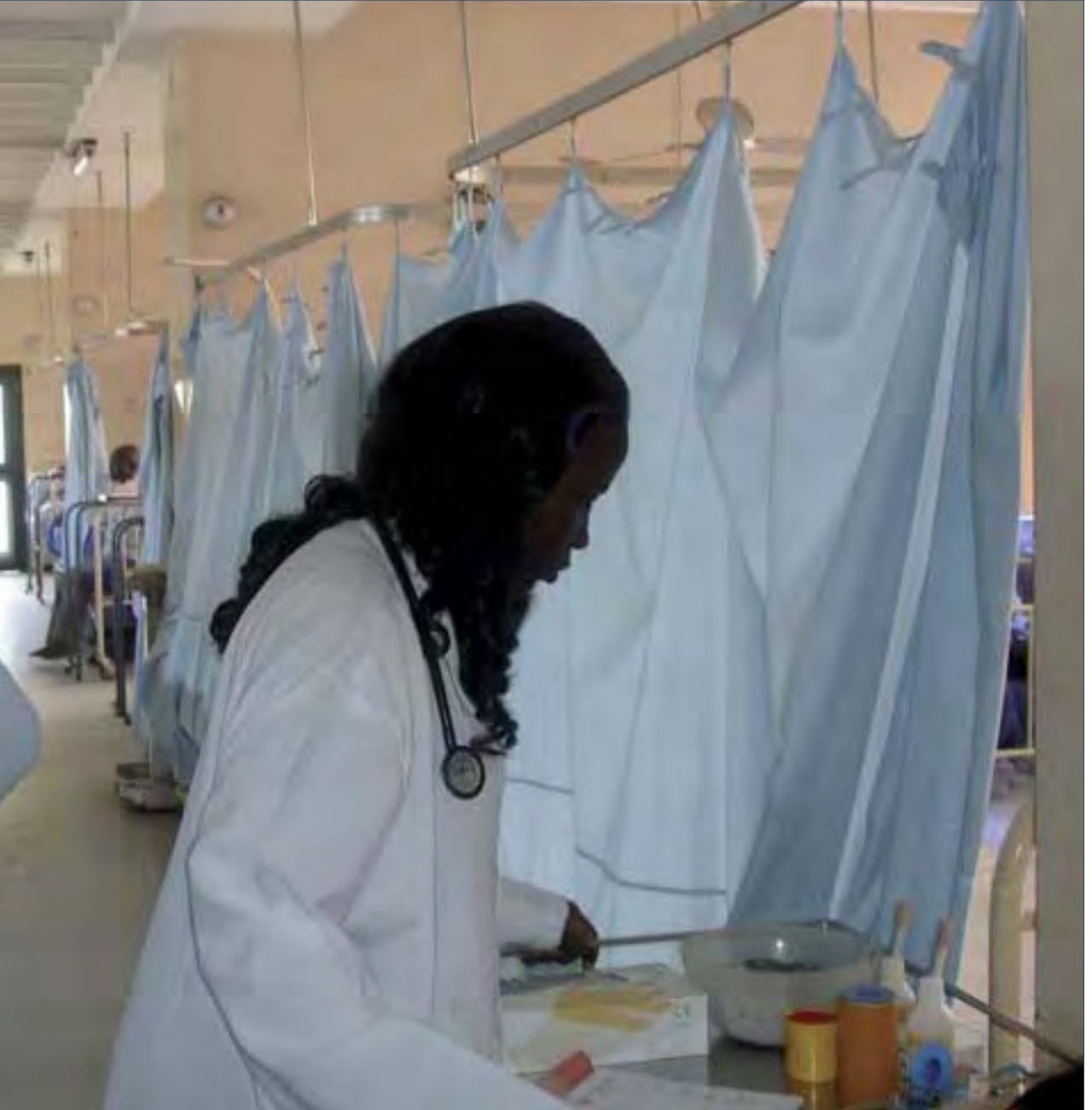
of care was enough in most cases to prevent early presentation to healthcare professionals. To our surprise, diseases such as diabetes and hypertension, which we had previously thought of as diseases of the western world, were becoming increasingly prevalent, and ward admissions for complicated or late-presenting cases of such diseases were quite common.

What was most apparent to us on this trip was the wealth of underdeveloped and aspiring talent. Aside from the knowledge we could provide, our most valued contribution as seen by these young people and the Foundation in Nigeria was that of a much-needed boost and motivation. For the resident coaches and facilitators who were all volunteers, we represented a vehicle which could be used to convey some of their struggles, achievements and aspirations for the future to the general public. Although the Foundation makes exceptional efforts to find sponsorships for programmes like apprenticeships where the route of academia is not desired or feasible due to lack of funding, they are unfortunately limited, due to lack of funds and support from the local government.

On the whole we thoroughly enjoyed our time in Nigeria, and we left full of aspirations for the continuity and the development of the Foundation. This initial trip has helped to establish what will be a continuing partnership. In the coming years we hope that other students will participate in this project, in the process giving something tangible back to the global community whilst also gaining an enriching experience which might contribute to their own personal development. ■



**To our surprise, diseases such as diabetes and hypertension, which we had previously thought of as diseases of the western world, were becoming increasingly prevalent, and ward admissions for complicated or late-presenting cases of such diseases were quite common.**



**King's student Oluwafunke Mohammed working in a Nigerian hospital.**



# On parchment to **ONLINE**

**Records which provide a fascinating glimpse into many aspects of medieval life can now be searched online and read in English, thanks to a joint project between King's and The National Archives which is making the 'Fine Rolls' of Henry III available through the internet.**





**The first great seal of Henry III, which is attached to documents granting the moor of Alfietmore to Stanley Abbey in exchange for the surrender of land and the right to take wood in Chippenham Forest, Wiltshire. TNA PRO E42/315.**

**The centrepiece for Henry III's renovation of Westminster Abbey was the shrine of St Edward the Confessor (right). Henry's own tomb was nearby (centre left).**

**T**he Fine Rolls of Henry III were written in Latin on parchment between 1216 and 1272, in order to record offers of money – ‘fines’ – to the King to obtain a variety of concessions and favours. The first entry is about the release of a rebel from prison during the 1215-17 civil war.

‘Henry III was the son of King John, and his long reign saw the implementation of the Magna Carta into English political life and the beginnings of the parliamentary state,’ explains David Carpenter, Professor of Medieval History at King’s, who is leading the project. ‘These records are vital for understanding royal patronage, the position of women, the changing nature of the gentry, the development of the common law and the commercialisation of the economy in this period.’

The project has funding from the Arts & Humanities Research Council and will initially run over three years. Previously the only version of the Rolls that was available, other than the original, was a two-volume printed version covering about 15 per cent of the whole, in Latin, published in 1835-6. ‘Translating the rolls, and enabling them to be searched online, transforms them from something accessible only to professional historians and archivists into a resource for students, school pupils, amateur historians, the heritage industry, family researchers and anyone else who is interested’, Professor Carpenter adds.





**Henry III was the builder of Westminster Abbey, and King's and the Abbey were joint organisers of events held to mark the 800th anniversary of his birth in 2007, including a colloquium at King's and this act of commemoration in the Abbey.**



GREG FUNNELL

**For over a century the Rolls were kept in a building on the site of what is now King's Maughan Library in Chancery Lane, formerly the Public Record Office.**

### **Earliest group**

The digitised version of the earliest group of Rolls, covering the period from 1216 to 1248, was completed early in 2007 by the Department of History and King's internationally renowned Centre for Computing in the Humanities, and the website for the project, [www.finerollshenry3.org.uk](http://www.finerollshenry3.org.uk) was launched in May. The launch took place at the College's Maughan Library, which is housed in the former Public Record Office building in Chancery Lane, London: a particularly appropriate venue because it is where the Rolls were kept for over a century, before their move in the 1990s to the National Archives at Kew. Henry III too has a direct link with the Maughan Library, since he founded the House for Converted Jews on whose site the Library now stands, and there is a statue of him, holding his 'House', at the Library.

A print version of the work will also be available in a four-volume book, published by Boydell & Brewer, and the first volume was launched at a conference held at King's to mark the 800th anniversary of the birth of King Henry on 1 October 2007. An account of the period covered by the Rolls is given in David Carpenter's book, *The Struggle for Mastery: Britain 1066-1284* (Penguin paperback, 2004).

### **Women**

Many of the Rolls' entries relate to women. 'Women of this period could hold property but their rights were inferior to those of men', David Carpenter explains. 'A woman would only inherit if she had no brother. If she was not an heiress, she might be given a marriage portion by her family to take into marriage. In marriage the husband had total control over his wife's inheritance (if she had one), and also her marriage portion. Widows recovered control of both, however, and also were entitled, as dower, to a third of their late husbands' lands. But if they re-married, their new husbands got control of all three.'

### **Lady not for turning**

The 'Fine of the month' feature on the Rolls website encourages contributors from outside the project team to comment on material of particular



significance in the Rolls. The December 2006 contribution, by Michael Ray, a PhD graduate from King's, focuses on one of the many sequences about women. His article 'The Lady is not for turning. Margaret de Redvers' fine not to be compelled to marry' examines the fine made by a prominent widow in 1229 so that she could not be forced to marry again. Details are found in the roll for the regnal year 13 Henry III (28 October 1228-27 October 1229), which is item number 325 in the online translation.



**Professor David Carpenter discusses the Fine Rolls with Terry Jones of *Monty Python* fame at the launch of the online version in May 2007. Terry Jones has written books and presented television documentaries on medieval and ancient history.**

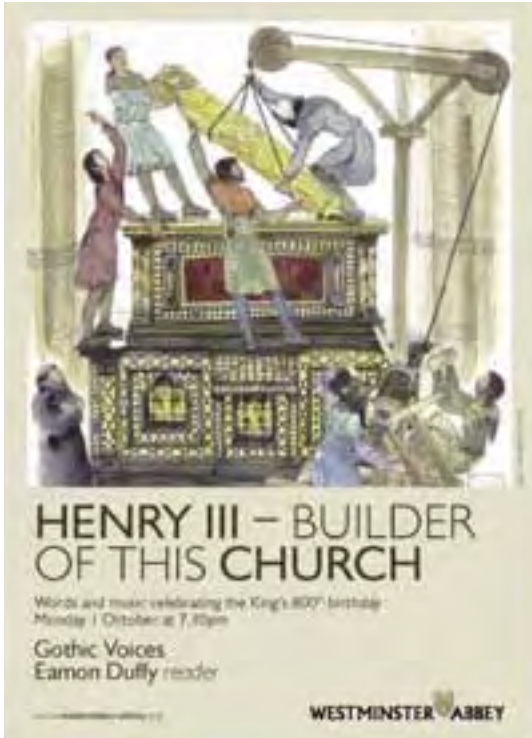


GREG FUNNELL

Margaret, who was born about 1200, was the only child of Warin Fitzgerold, hereditary joint Chamberlain to the English throne. She inherited fortunes from both her parents, and at about the age of 15 she was married to Baldwin I, the heir of William de Redvers, Earl of Devon. Her husband died in the year after their marriage, leaving her either pregnant or with a young son. Her widowhood made her one of the greatest catches in England's marriage market, and within weeks King John arranged for her to

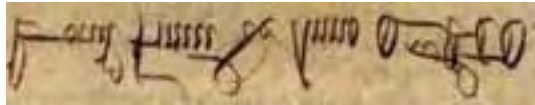
be married again to Falkes de Bréauté, a much disliked, if effective, Norman soldier of uncertain origins. In 1224 Falkes was exiled by Henry, and Margaret came to the King and the Archbishop of Canterbury, claiming that she had never given her consent to the marriage in the first place and asking for a divorce. This was not granted, but Falkes died in Rome in 1226, and after enduring two enforced marriages it seems that Margaret was willing to pay a 'fine' so as not to be obliged to marry again.





**Magna Carta**

It is perhaps surprising that Margaret did not rely on Magna Carta to protect her, since the Charter guaranteed that no widow should be ‘compelled to marry so long as she wishes to live without a husband, provided that she gives security that she will not marry without our [ie the King’s] consent.’ The Charter, however, was not in place at the time of Margaret’s first marriage and it had been annulled at the time when King John arranged her re-marriage. The minority government of Henry III, in order to win the war raging on John’s death and then secure the peace, issued new versions of Magna Carta (that of 1225 became definitive). Margaret, however, after her experiences, was still evidently fearful and wanted more individual protection. She was not alone, and between 1218 and 1234 at least 11 other widows purchased the right not to marry, or to marry whom they wished. However, it would be wrong to think the Charter made no difference. The numbers of widows making such fines was far smaller than under King John, as were the amounts



**Above:** In the early years of Henry’s minority each fine roll bears an ornate title heading on its head membrane, testament both to the scribes’ draughtmanship and artistic talents. There are numerous other examples of the scribes’ creativity and desire for distinctive references throughout the main body of the Fine Rolls. TNA PRO C60 m.7d. accompanies the roll headers. **Far left:** A poster for the service of commemoration for Henry III as builder of Westminster Abbey.



**Above:** Drawing of a woman’s head, probably Mirabel, widow of Elias the Jew, as it appears next to a record stating that she paid 15 marks (£10) for custody of her late husband’s house in Gloucester. The King also told barons of the Exchequer that she did not need to answer for the debts her husband owed to King John. TNA PRO C60/7.

of money they offered. Sometimes the government was careful to protect individual women. In 1219 it stipulated that Matilda, widow of James de Neufmarché, must give written consent to a second marriage through her own letters patent. Margaret remained a widow until her death in 1252 and presumably continued to control her own destiny. ■

**COMPUTING AT KING’S**

The Centre for Computing in the Humanities at King’s is the international leader in the application of technology to research in the arts, humanities and social sciences and is involved in more than 20 major research projects, funded by the AHRC, the Joint Information Systems Committee, the Leverhulme Trust and the Andrew W Mellon Foundation. The Centre has provided consultancy to more than 450 cultural institutions on all aspects of digitisation and is currently working with South African universities to digitise the life and work of King’s alumnus Archbishop Desmond Tutu. The Centre comprises the King’s Visualisation Laboratory, which specialises in the creation of 3D models of historical theatres and other major cultural sites, including the Theatre of Pompey in Rome, which has been the subject of national press and television coverage.

**A statue of Henry III stands over the gateway of King's Maughan Library, on the site where the Rolls were once kept.**



PHIL SAVER

# Older fathers & **AUTISM**

**Children whose fathers were 40 and older at the time of their birth are almost six times more likely to have autism spectrum disorders than those whose fathers were under 30, according to research by Dr Abraham Reichenberg of the Institute of Psychiatry at King's.**

ROLPH GOBITS/LENS MODERN







**A**utism is a condition that is characterised by social and language abnormalities and repetitive patterns of behaviour. Autism and related conditions such as Asperger syndrome, known collectively as autism spectrum disorders, have become increasingly common. They now affect 50 in every 10,000 children, as compared with five children in 10,000 two decades ago.

‘This increase is partly due to higher levels of awareness and changes in diagnosis processes, but it could also reflect an increase in the incidence of autism’, explains Dr Reichenberg. ‘Older parental age has previously been linked to abnormalities in the brain development of children, but few studies have effectively examined the effect of mothers’ – and especially fathers’ – ages on autism.’ In the UK the number of fathers aged 40 or over rose by a third between 1999 and 2004.

**Large sample**

Working with colleagues from the Mount Sinai School of Medicine, New York, and from universities in Israel, Dr Reichenberg evaluated the association between fathers’ ages and autism in over 300,000 children born during the 1980s in Israel. This was done by obtaining information from the Israeli military draft (national service) board. In this data, the age of the father was available for 318,506 17-year-olds who were being assessed by the board for compulsory military service, and the age of the mother was available for 132,271 of those. Information on the individuals who were not eligible for military



ISTOCKPHOTO

service because of autism or related disorders was reported to the draft board by government agencies and other organisations responsible for their care and protection.

‘Two hundred and eight individuals in the larger group (a rate of 6.5 per 10,000) had a diagnosis of autism spectrum disorder, according to the information in the draft board registry’, says Dr Reichenberg. ‘When the 17-year-olds were categorised by the age of their father at



**Peter Myers,**  
**‘Peter’s Hand. Mark XI- D’ and**  
**‘Peter’s Hand. Mark V’.**

When the 17-year-olds were categorised by the age of their father at birth, it was clear that advancing age among fathers was associated with increased risk of autism, both in boys and girls.



© PETER MYERS

Peter Myers, 'Depression picture', 2005.



birth, it was clear that advancing age among fathers was associated with increased risk of autism, both in boys and girls.’

This association persisted after the research was ‘controlled’ to eliminate effects due to the children’s year of birth, their socio-economic status and their mother’s age, producing results showing that the odds of autism spectrum disorder were nearly six times greater among children whose fathers were 40 and older when

they were born than those whose fathers were 29 or younger. Once the researchers factored in the effect of the father’s age, older age among mothers was not associated with autism.

‘Although further work is necessary to confirm this interpretation, we believe that our study provides the first convincing evidence that advanced paternal age is a risk factor for autism spectrum disorder’, Dr Reichenberg concludes. He points out that other studies have shown that the older age of the father at the time of birth is associated with several other neurological and psychiatric disorders, such as schizophrenia.

**Genetic mechanisms**

He and his co-authors have put forward several possible genetic mechanisms for the paternal age effect, including an accumulation of spontaneous mutations in sperm-producing cells or alterations in genetic ‘imprinting’ which affects gene expression.

He adds, however: ‘It is important to keep in mind that age at paternity is influenced by the socio-cultural environment and varies across societies and over time. Over the past two decades there has been an increase in age of paternity in the western world, which, considering that paternal age is a risk factor, could contribute to the increase in rates of autism.’ The project has since been replicated by three other research groups working with populations in Denmark and the United States. ■

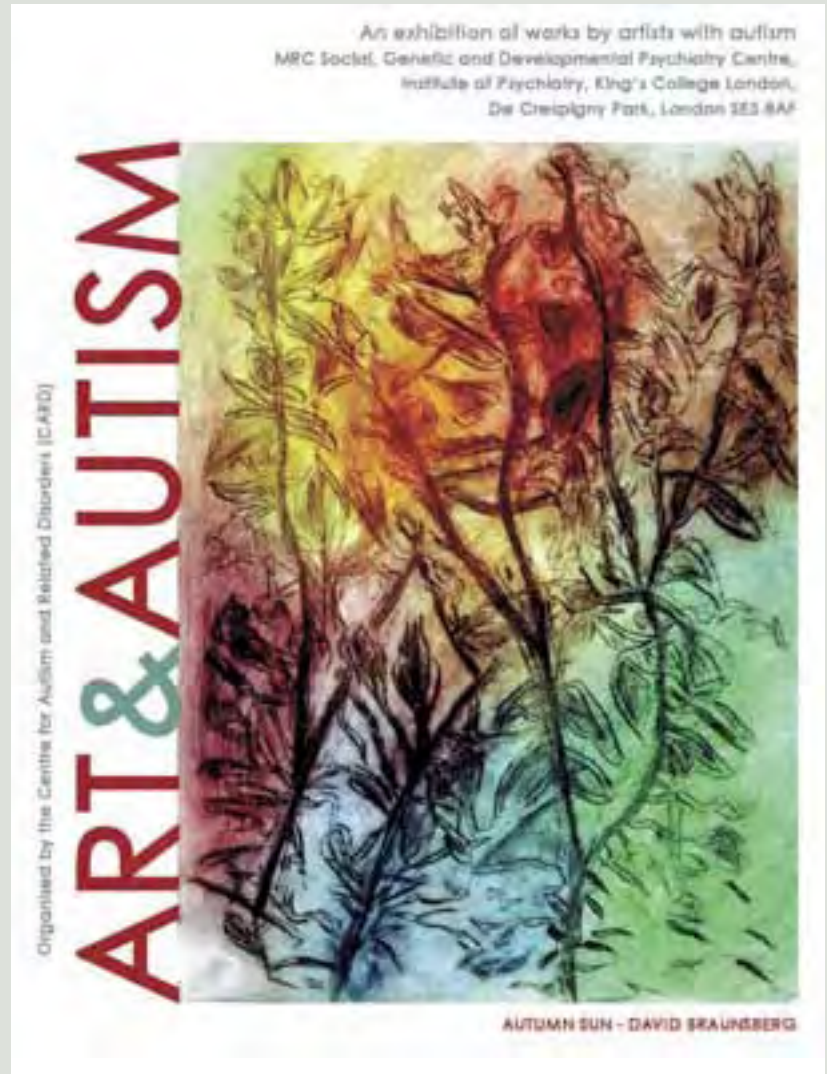
*The article was published in the September 2006 issue of Archives of General Psychiatry, one of the journals of the American Medical Association.*



**Seven-year-old Sam, seen here with a portrait of Einstein and his own self-portrait, was the youngest exhibitor in the *Art and Autism* exhibition held by the Centre for Autism and Related Disorders at the Institute of Psychiatry at King’s in 2006.**



**It is important to keep in mind that age at paternity is influenced by the socio-cultural environment and varies across societies and over time.**



**David Braunsberg,  
'Autumn Sun'.**

# FACTS, FIGURES & FINANCES 2006-7

## Student numbers by School and level of study

Headcount on 1 December 2006.

School	Campus	Undergraduate	Graduate taught	Graduate research	Total	% of total students
Biomedical & Health Sciences	Guy's and Waterloo	2,088	272	213	2,573	13.3%
Dentistry	Guy's, Strand, Denmark Hill and St Thomas'	901	100	62	1,063	5.5%
Humanities	Strand	1,977	442	247	2,666	13.8%
Institute of Psychiatry	Denmark Hill	43	461	308	812	4.2%
King's Institute for Learning & Teaching	Waterloo		118		118	0.6%
Law	Strand	953	970	57	1,980	10.3%
Medicine	Guy's, Denmark Hill and St Thomas'	2,145	285	203	2,633	13.6%
Nursing & Midwifery	Waterloo	2,428	129	51	2,608	13.5%
Physical Sciences & Engineering	Strand	1,390	315	140	1,845	9.6%
Social Science & Public Policy	Strand and Waterloo	1,051	1,525	343	2,919	15.1%
Junior Year Abroad & Overseas Exchange	Strand	93			93	0.5%
<b>Total</b>		<b>13,069</b>	<b>4,617</b>	<b>1,624</b>	<b>19,310</b>	<b>100%</b>

## Student numbers by gender 2006-7

	Undergraduate	Graduate taught	Graduate research	Total	% of total students
Female	8,317	2,515	865	11,697	60.6%
Male	4,752	2,102	759	7,613	39.4%
<b>Total</b>	<b>13,069</b>	<b>4,617</b>	<b>1,624</b>	<b>19,310</b>	<b>100%</b>

## Student numbers by age range

(at start of course, 2006-7)

	Undergraduate	Graduate taught	Graduate research	Total	% of total students
20 and under	9,075	27	2	9,104	47.1%
21-29	2,650	2,825	1,015	6,490	33.6%
30-39	843	1,150	382	2,375	12.3%
40-49	406	490	160	1,056	5.5%
50 and over	95	125	65	285	1.5%
<b>Total</b>	<b>13,069</b>	<b>4,617</b>	<b>1,624</b>	<b>19,310</b>	<b>100%</b>



### Students' country of domicile 2006-7s

King's has a strong international community including students from 128 countries.

Location	Number	% of students
Great Britain	15,229	78.9%
European Union	1,716	8.9%
Other countries	2,365	12.2%

### Students in halls of residence

(at 1 December 2006).

King's students in College residences	2,540
King's students in University of London intercollegiate residences	470

### Staff

(at 30 November 2006) excluding senior students, honorary and occasional staff.

Academic and research	2,937
Non-academic	2,374
<b>Total</b>	<b>5,311</b>



**The College Council in session, March 2007, in the historic Council Room which was part of the College's original building, opened in 1831.**

### Income and expenditure (for the year ended 31 July 2006)

In 2006 King's was once again awarded an 'AA-' financial credit rating from Standard & Poor's.

Income	£000
Funding Council grants	127,824
Tuition fees and education contracts	68,384
Research grants and contracts	110,637
Other operating income	73,089
Endowment income and interest receivable	8,017
<b>Total income</b>	<b>387,951</b>

Expenditure	£000
Staff costs	237,541
Depreciation	14,828
Other operating expenses	113,700
Interest payable	9,892
<b>Total expenditure</b>	<b>375,961</b>

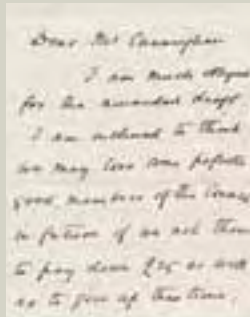
	£000
Surplus on ordinary activities	11,990
Taxation	1
<b>Surplus after depreciation of assets at cost, disposal of property and tax</b>	<b>11,989</b>



The College's register shows the transfer of shares in King's from John Gladstone to his son, the future Prime Minister William Ewart Gladstone, in 1830. WE Gladstone served as a member of the College Council and Life Governor from 1838 to 1898.

**The Council: a portrait was published by the College in July 2007 to record and celebrate the role of King's governing body from 1829 to the present, and to mark Lady Rawlings' chairmanship of Council from 1998 to 2007.**

King's governing bodies have, over nearly 180 years, had a very distinguished membership, including four royal dukes, four prime ministers, many other statesmen, philanthropists, members of the judiciary, business leaders, inventors and the 'great and good' of all descriptions. The famous Victorian statesman WE Gladstone was not only the longest-serving member of King's Council, on which he sat for some 60 years, but also a very active and helpful friend towards the College throughout his life. Among the philanthropic families who supported the College over several generations were the Twinings of tea fame and the WH Smith stationers' dynasty.



**Letter from Cholmeley Austen-Leigh, a member of Jane Austen's family, cautioning against asking members of the Council of King's to pay for the privilege.**



**A copy of Elizabeth Twining's *Illustrations of the Natural Orders of Plants* (1868) was given by her sister Louisa to the Ladies' Department of King's and is still in the College's Foyle Special Collections Library.**

## Members of the Council of King's College London at 31 July 2007

### Ex officio members

Professor Richard Trainor BA MA DPhil FRHistS AcSS FKC, Principal

Professor Keith Hoggart BSc MSc PhD FKC, Vice-Principal (Arts & Sciences)

Professor Robert Lechler PhD FRCP FRCPATH FMedSci FKC, Vice-Principal (Health)

Professor Sir Lawrence Freedman KCMG CBE FKC, Vice-Principal (Research)

Professor Phil Whitfield BA MA PhD FKC, Vice-Principal (Students)

Harry Musselwhite BA FKC Barrister, Director of Employee Relations

### Appointed members

The Right Reverend Dr Tom Butler BSc CEng, Bishop of Southwark (after consultation with the Visitor)

Steven Rhodes BD AKC, DipL Barrister (after consultation with the King's College London Association)

*Eighteen other (lay) persons neither employees nor students of the College:*

Paul Allison

Adam Boulton

Mrs Blondel Cluff

Patrick Disney

Professor Charles Easmon CBE MD PhD

Professor Trevor Jones CBE PhD FRSC FPS FKC, Vice-Chairman

The Hon Mrs Isabelle Laurent

Andrew Leung

Sir Michael Pakenham KBE CMG

The Hon Mrs Olga Polizzi CBE FKC, Vice-Chairman

David Potter MA FKC, Treasurer

David Price

Baroness Rawlings BA Hon LittD FKC, Chairman

James Ritblat

Duncan Selbie

His Hon Judge Toulmin CMG QC FKC

Ms Fields Wicker-Miurir OBE BA MA CEP

Veena, Lady Williams of Mostyn

### Elected members

*Eight persons elected from among their number by the academic staff of the College:*

Professor Paul Ciclitira MB BS PhD MRCP FRCP

Ms Angela Parry

Professor Chris Hamnett BA

Professor Simon Howell BSc PhD DSc FKC

Dr Mark Miodownik BA DPhil

Dr Stewart Paterson BSc PhD

Professor Tom Sanders BSc PhD DSc RPHNutr

Dr Mike Slade BA BSc MSc PsychD PhD DipPsych RMN AFBPS CSci CPsychol

*Three persons elected by the students of the College from among their number:*

Daryn McCombe

Adam Farley

Ms Jo Williams

*Two persons elected from among their number by the staff of the College who are not members of the academic staff:*

Ken Bromfield MBE

Ms Pauline Walker

### Clerk to the Council

Ian Creagh BA Dip Ed MA, Head of Administration & College Secretary



## ACKNOWLEDGEMENTS 2006-7



### The Foyle Special Collections Library

This outstanding Collection, consisting of over 110,000 printed works, is a priceless research resource, not only for the staff and students of King's, but also for the wider academic community within the UK and abroad. Each year, alumni, staff and friends generously support vital conservation work, ensuring the long-term survival of the Collections for future generations.



### The Rosalind Driver Research Scholarship

The Rosalind Driver Research Scholarship Fund will advance our understanding and delivery of the most effective methods of science education.

**We are grateful to all those who have so generously supported the College over the last academic year. Gifts from individuals, grant-making trusts and other organisations have opened up new areas for clinical and academic research, established scholarship opportunities for our most talented students, and created new academic posts and better facilities. We thank all our supporters (including those who prefer to remain anonymous) who are helping to fulfil our vision for the College. In particular, we warmly acknowledge the support of the following:**

Action on Addiction	British Cardiovascular Society	Dr John Crocker & Mrs Josephine Crocker AKC FKC, née Frearson	Dunhill Medical Trust
Alicia Koplowitz Foundation	British Eye Research Foundation	Republic of Cyprus Ministry of Education and Culture	Edmond J. Safra Philanthropic Foundation
Alzheimer's Association (USA)	British Heart Foundation	Dana Foundation	Eduserv
Alzheimer's Research Trust	British Skin Foundation	The late Mr John M Davis	Fondazione Maruzza Lefebvre D'Ovidio Onlus Foundation
Alzheimer's Society	His Majesty the Sultan of Brunei	Diabetes UK	Food Allergy Initiative
Anna Trust	Mr & Mrs John D Burton	The late Mrs Marjorie G Dibden	Mr Geoffrey H Forman
Arthritis Research Campaign	Calouste Gulbenkian Foundation	Mr Bill Dodwell	Friends of Guy's Hospital
Association for International Cancer Research	Cancer Research UK	Rosalind Driver TQ/KCL Trust	Friends of King's College London (Canada)
Asthma UK	Chronic Disease Research Foundation	The late Dr William S Dunbar	Friends of King's College London (Hong Kong)
The Atlantic Philanthropies	Mrs Maryann Cochrane		Friends of King's College London (USA)
Banco Espirito Santo	The Coles Family Foundation		Bill and Melinda Gates Foundation
Breast Cancer Campaign			Mr Paul Getty III
British Academy			



### **The Cicely Saunders Institute of Palliative Care**

The world's first Institute of Palliative Care is dedicated to research and teaching in the field of the care of people with progressive illness. The Centre, at King's Denmark Hill Campus, is scheduled to open in late 2009.



### **The Desmond Tutu Digital Archive Project**

This Project will provide unique access to the personal papers of an outstanding African leader.

Dr Terence J Gibson	King's College Hospital Charitable Trust	National Institute of Health	St Giles Trust
The late Miss Pamela J L Goodwin AKC	King's College London Engineers' Association (KCLEA)	National Kidney Research Fund	Tommy's The Baby Charity
Guide Dogs for the Blind Foundation	King's Fund	The National Lottery	Tubney Charitable Trust
Guy's & St Thomas' Hospital Kidney Patients' Association	King's Medical Research Trust	Nuffield Foundation	Volkswagen Foundation
Guy's & St Thomas' Charitable Foundation	Mr William Kwan FKC	Oak Foundation	Wellchild
Hadwen Trust	Dr Eugene P Lambert	Open Society Foundation for South Africa	Wellcome Trust
Mr & Mrs Tony Hancock	Leukaemia Research Fund	Mr Nicholas Oppenheimer	The Garfield Weston Foundation
Lord Harris of Peckham FKC & Lady Harris	A G Leventis Foundation	Parkinson's Disease Society	Mr Christopher Wiscarson
The Health Foundation	Leverhulme Trust	Pfizer Inc.	Charles Wolfson Charitable Trust
Juvenile Diabetes Research Foundation International	Mr Terence Y K Lo	Psychiatry Research Trust	The Wolfson Foundation
Mr Kristnaswamy Kasturirangan	Professor Arthur Lucas CBE FKC & Mrs Paula Lucas	Mr Gary Ralfe	
Mr Henry Keswick & The Hon Mrs Tessa Keswick FKC	Motor Neurone Disease Association	Mr Steven Rhodes AKC	
Kidney Research UK	Muscular Dystrophy Campaign	Royal Society	
	The Mental Health Research Association (USA)	Mr Bernhard C Rumbold	
	National Cancer Research Institute	Mrs Lily Safra FKC	
		Cicely Saunders Foundation	
		The Schilizzi Foundation	
		The Schroder Foundation	
		The Henry Smith Charity	
		Society for Mucopolysaccharide Diseases	

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