

Research

Research at Bristol includes much that is of public benefit. The University's activity is engaged in the fullest sense: engaged with urgent issues such as disease, climate change, energy, social justice, natural resources and the welfare of the individual; engaged with the cultural life and history of nations and communities across the world; engaged with the future of technology and science and the development of innovations in medicine, nanotechnology, quantum cryptography, composite materials, stem-cell engineering and other emerging fields.

The University's priorities in this area are to:

- be recognised globally for the quality of our research;
- create a positive research environment and infrastructure that will attract and retain the highest quality researchers and postgraduate students worldwide;
- develop our portfolio of flagship and high-impact research, working across and between disciplines to answer important societal questions and contribute to the social, political, environmental and economic well-being of the region, the UK and the wider world;
- seek, manage and provide professional support for strategic relationships and alliances with key national and international partners – business and industry, the public sector, user communities, sponsors of research and policy-makers;
- play a leading intellectual role in enterprise, knowledge exchange and economic and social impact agendas, and continue to be a beacon of good practice and leader of innovation in the city and region;
- develop a sustainable portfolio of research informed by evidence-based leadership, management and administration and supported by high standards of governance.

Bristol leads on National Composites Centre

The University is leading a new centre for design, manufacture and marketing of composite materials for widespread use in industry. The National Composites Centre will form an international hub, linking activities across all sectors of the UK in research, education and training, technology transfer and incubation of new enterprises.

Composites are manufactured from high-performance fibres such as carbon fibre, and their development is a key strategy in cutting the environmental impact of industries (aerospace, construction, automotive, renewable energy, etc) that have traditionally been heavy carbon emitters.

The Centre is being funded by the Department of Business, Innovation and Skills, the South West Regional Development Agency and the European Regional Development Fund. Some of the world's leading engineering companies are to participate in the centre, including Vestas, Rolls Royce, AgustaWestland, Airbus UK and GKN. A purpose-built facility is under construction at the Science Park (or S-Park) in Emerson's Green and is expected to be ready in spring 2011.

A simple calculation, a world first

Quantum computing is now a step closer, after a team at the Centre for Nanoscience and Quantum Information performed a simple calculation on a photonic chip. The experiment was conducted on a primitive quantum computer that uses single particles of light (photons) whizzing through a silicon chip. This world first, part of research led by Professor Jeremy O'Brien, Director of the Centre for Quantum Photonics, is a major

step forward in the quest to realise a super-powerful quantum computer. Areas in which quantum computing could fuel major advances include the development of new pharmaceuticals and materials and the arrival of a new standard for encryption and secure internet communication.

Preventing brain injury in newborns: a banner year

Neonatal research at Bristol made several important breakthroughs in 2009/10, mostly through the work of Professor Marianne Thoresen and Professor Andrew Whitelaw.

The results of a trial involving 42 universities in Europe and Israel – the largest study of its kind – found that brain damage caused by lack of oxygen at birth could be mitigated if infants are given cooling treatment within the first six hours of life. This confirms the research, begun by Professor Thoresen in 1992 and subsequently funded by the Medical Research Council, which suggested that mild cooling reduces injury in the newborn brain after hypoxia.

Cooling by itself only partially reduces disability and does not prevent it in all babies. However, in April it was announced that another pioneering technique developed by Professor Marianne Thoresen had proved successful, when xenon gas was delivered to a newborn baby deprived of oxygen at birth. This was carried out, in combination with the cooling treatment, at St Michael's Hospital, part of University Hospitals Bristol NHS Foundation Trust. Professor Thoresen developed the use of xenon gas with Dr John Dingley from Swansea University, in a study funded by Sparks, the children's medical research charity.

Research continued

Another line of research bore fruit when details were published of a new treatment that reduces disability in premature babies with serious brain haemorrhage by washing the brain to remove toxic fluid. The development of the technique, known as DRIFT (Drainage, Irrigation and Fibrinolytic Therapy), was led by Professor Andrew Whitelaw and Ian Pople (paediatric neurosurgeon at North Bristol NHS Trust), and a randomised trial, funded by grants from Cerebra and the James and Grace Anderson Trust, began in 2003. Its success means that the technique, now known as ventricular lavage, is likely to be set up as a service at Bristol's Southmead Hospital.

Found: Alfred the Great's granddaughter

Bones excavated in Magdeburg Cathedral in 2008 were confirmed as those of Saxon Princess Eadgyth. Dr Alistair Pike and Professor Mark Horton from the Department of Archaeology studied the teeth preserved in the upper jaw by measuring the strontium and oxygen isotopes that were mineralised in the teeth as they were formed. The results clearly indicated a childhood spent in the chalk regions of southern Britain. Meanwhile, colleagues from the University of Mainz made similar measurements of teeth from burials of people local to Magdeburg and confirmed that these isotopes were completely different. Princess Eadgyth was the granddaughter of Alfred the Great and died in AD 946, making hers the oldest surviving remains of an English royal burial. The discovery attracted great media interest; the bones will be reburied in Magdeburg Cathedral later this year, 500 years after their last interment in 1510.

Bristol leads in poverty research

The Centre for the Study of Poverty and Social Justice, established in 1998 at the School for Policy Studies, provides a focal point for scholarship and research in criminal justice, socio-legal studies, poverty and social exclusion. During 2009/10 the Centre's projects included a number of high-profile studies, the outcomes of which are expected to inform government policy and practice.

The Centre's Dr Eldin Fahmy led a study of social exclusion commissioned by the Cabinet Office, building on earlier work led by Professor Ruth Levitas from the Department of Sociology that resulted in the Bristol Social Exclusion Matrix (BSEM). Dr Fahmy used the BSEM framework for the new study, along with data from the General Household Survey and the British Household Panel Survey. The findings, published by the Cabinet Office, indicate that 16 per cent of working-age adults without children over the age of 25 – or 2.6 million people – experience multiple forms of social exclusion at any one time.

Meanwhile, one of the Centre's member groups, the Townsend Centre for International Poverty Research, is a leading partner in the UK's largest-ever research project into poverty and social exclusion. The initiative is funded by the Economic and Social Research Council, and also involves researchers from Heriot-Watt University, the National Centre for Social Research, Northern Ireland Statistics and Research Agency, The Open University, Queen's University Belfast, University of Glasgow and the University of York. The project aims to support the ambitions of the Child Poverty Act 2010, which formalises the UK's commitment to ending child poverty by 2020.

Driverless transport wins award

A revolutionary form of driverless travel – the ULTra (Urban Light Transport) – pioneered at the University's Faculty of Engineering won the Viva Award for 2009. ULTra was conceived by Martin Lowson, Emeritus Professor of Advanced Transport and President of Advanced Transport Systems Ltd. The Viva Award recognises transport innovation or development in Europe; ULTra is an innovative form of Personal Rapid Transit that uses 70 per cent less energy per passenger-kilometre than a car. ULTra was featured at the Science Museum as 'the 21st-century equivalent of Stephenson's Rocket'. This year the first public ULTra system – also the first commercial Personal



STATE OFFICE FOR HERITAGE MANAGEMENT AND ARCHAEOLOGY, SAXONIANPALI



ADVANCED TRANSPORT SYSTEMS LTD

Top: The raising of the lid of Princess Eadgyth's tomb
Bottom: The ULTra in action

Rapid Transit system anywhere in the world – opened at London's Heathrow Airport.

Hearing on the wing

Bionanoscience is an emerging field of study, as researchers bring computing power and nanoscale technology to bear on the natural world. Professor Daniel Robert's research group in the School of Biological Sciences investigates some of the smallest working structures in nature, in collaboration with colleagues in the Department of Engineering Mathematics and elsewhere. During 2009/10, members of these groups published two groundbreaking studies of the mechanisms behind insect hearing.

The ear of a tropical butterfly contains a structure that enables it to distinguish between high- and low-pitch sounds, according to a paper in the *Journal of Experimental Biology*. Lead researcher Katie Lucas used a tiny laser beam to scan the surface of the ear, which consists of a membrane at the base of the wing, and found that lower-pitch sounds caused vibrations in only one part of the outer membrane while higher-pitch sounds made the entire membrane vibrate. Lucas and her colleagues (at Bristol, the University of Strathclyde and Carleton University, Ontario) argue that the structure of the membrane may enhance the abilities of these butterflies to listen for birds by detecting the beating of birds' wings (lower pitch) and tuning into birdsong (higher pitch).

Some of the remarkable features of mosquito hearing – including the male's ability to hear the faintest beats of the female's wings without being deafened by much louder noises – have been explained by a mathematical model produced at the Bristol Centre for Applied Nonlinear Mathematics. Building on the discovery by Professor Robert of the process of hearing in male mosquitoes through multiple individual sensory units called scolopidia, postdoctoral researcher Dr Daniele Avitabile and colleagues developed a mechanistic model of the active amplification in the Tanzanian mosquito species *Toxorhynchites brevipalpis*. The model (described in a paper

in the *Journal of the Royal Society Interface*) tallies with recent experiments and observations, and also generates new hypotheses about the details of the process.

Lost voyage comes to light

Evidence of a previously unknown voyage to North America in 1499, led by Bristol explorer William Weston, was published by Dr Evan Jones from the Department of History in the journal *Historical Research*. In a letter from Henry VII to his Lord Chancellor, the King instructs him to suspend an injunction served against Weston in the Court of Chancery because Weston shall shortly 'with God's grace pass and sail for to search and find if he can the new found land'. The letter had an odyssey of its own, having been miscatalogued, rediscovered and almost destroyed, before Dr Jones finally brought it to public attention.

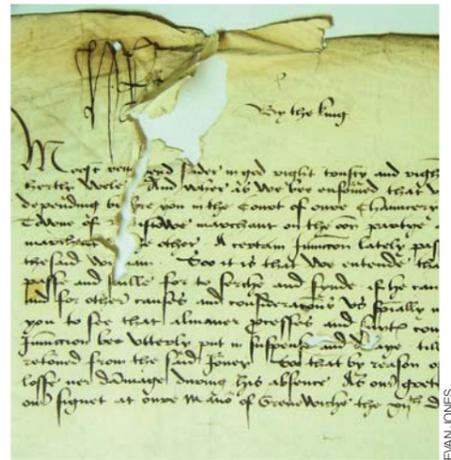
Taking research to market: SETSquared

RED manages the University's SETSquared Business Acceleration Centre, part of the SETSquared Partnership, which also includes the universities of Bath, Southampton and Surrey. This enterprise collective comprises some 6,500 researchers, who together are responsible for 7 per cent of the UK's research budget. The Centre draws on in-house expertise and a wide consultancy network of entrepreneurs, academics and finance experts to support emerging technology companies with high growth potential.

Over 100 businesses are currently receiving support through the SETSquared Partnership. It was reported late in 2009 that, despite the recession, companies in SETSquared incubators received £52.5 million from private investors and venture capital funds, creating 142 new jobs in the process. In March 2010, the University's SETSquared Business Acceleration Centre was identified by FutureStory – an initiative showing how businesses across the UK are adapting to the new global economy – as a key player in ensuring Bristol's future economic success.



KATIE LUCAS



EVAN JONES

Top: The ear on the wing of the Blue Morpho butterfly
Bottom: The 'lost' letter from Henry VII

Research continued

Bristol Enterprise Competition

The winners of the 2010 New Enterprise Competition were Rupert Baker and Alex Ross, recent graduates from the Department of Mechanical Engineering, for Teamup, a free-to-access sports web application. Teamup allows users to join, create and share micro-events (informal gatherings to participate in sports and activities such as football, cycling, swimming, tennis, yoga, pilates, climbing, etc) in their local community. Teamup also allows providers of commercial services to manage and market their resources more effectively. The prize included £20,000 plus six months managed office space at the Bristol SETsquared Business Acceleration Centre.

The runners-up were:

- Lee Arromba, an undergraduate in the Department of Computer Science, for Accelormatix – software that allows a musician or band to create, manipulate and loop music in a live setting via simple hand or body movements;
- James Cornford, an undergraduate in the Department of Mechanical Engineering, for Sundio – a social enterprise using sustainable solar refrigeration technology to improve the efficiency and profitability of farming in rural India.

The entries were judged by a panel of experts from the sponsoring organisations including Bristol City Council, Business Link, Deloitte, EADS, IP Group, Motorola, Osborne Clarke, Santander, SETsquared Business Acceleration Centre (Bristol), Withers & Rogers and Wyvern Seed Fund.

Grants

The University attracted a total of £118 million in grants during 2009/10. This included the following:

£4.3 million from the Economic and Social Research Council for a major study of poverty in the UK to be led by Professor Dave Gordon from the Centre for the Study of Poverty and Social Justice. Poverty and Social Exclusion in the United Kingdom – the 2010 Survey, a 42-month research project, will involve colleagues from the School for Policy Studies, the Department of Sociology and the Norah Fry Research Centre, along with researchers at Heriot-Watt University, the National Centre for Social Research, Northern Ireland Statistics and Research Agency, the Open University, Queen's University Belfast, the University of Glasgow and the University of York. This is the largest grant ever awarded for poverty research in the UK.

£1.94 million from the National Institute for Health Research for DISCOVERY (Diagnosis of Symptomatic Cancer), a wide-ranging research programme led by the University's Department of Community-based Medicine (in partnership with the universities of Durham, Cambridge, Oxford and Cardiff, and with NHS Bristol) that aims to improve cancer diagnosis.

A Wellcome Trust Programme Grant of over **£1.7 million** for a study, by Professor Stafford Lightman and Dr Becky Conway-Campbell at the Henry Wellcome Laboratories for Integrative Neuroscience and Endocrinology, of stress hormones and their effect on genes in the brain and in the liver, the mechanisms of memory and the development of metabolic disease such as diabetes mellitus.

£2.7 million from the Tubney Charitable Trust for a project led by the Department of Clinical Veterinary Science (together with the RSPCA and the Soil Association) to improve the welfare of farm animals in the UK.

£1.7 million from the Engineering and Physical Sciences Research Council and the Arts and Humanities Research Council (through the RCUK Digital Economy programme) for a project that aims to revolutionise the design of wearable technologies for supporting research. PATINA (Personal Architectonics of Interfaces to Artefacts) will be led by the Department of Computer Science in collaboration with the universities of Brighton, Greenwich, Newcastle, Southampton and Swansea, and with involvement from Microsoft Research, Nokia Research and the Victoria and Albert Museum.

£1.3 million from the Wellcome Trust for trials of a device, developed by Professor Chris Probert in the School of Clinical Sciences and Norman Ratcliffe at the University of the West of England, that can 'sniff out' the presence of disease. OdoReader 'reads' the odour of stool samples to diagnose *Clostridium difficile*, a highly infectious gastro-intestinal disease that can cause severe diarrhoea, especially among hospitalised patients.

£357,430 from the Arts and Humanities Research Council to Professor Ad Putter in the Department of English for a study of verse forms in Middle English romances, in collaboration with the University of California Los Angeles and the Chaucer Studio at Brigham Young University.