

YOUR Manchester

*for engineering &
physical sciences alumni*

£50 MILLION INVESTMENT
FOR GRAPHENE

MANCHESTER ENERGY

CLIMATE CHANGE CENTRE
EXPANDS TO CHINA



IMAGES OF RESEARCH
BRINGING SCIENCE CLOSER TO THE PUBLIC

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EPS IN FIGURES

10,080 students currently studying in the Faculty

1,827 students on postgraduate taught courses

6,885 UK and EU students

1,380 undertaking postgraduate research

6,873 undergraduate students

£202 million Faculty income

3,195 come from overseas

£95 million research income

EPS PEOPLE

The Faculty is led by the **Vice-President and Dean, Professor Colin Bailey**, and comprises **nine academic Schools** and **four Research Institutes**. The Faculty Leadership Team also includes **four Associate Deans** who support key areas of activity, including **Research, Teaching and Learning, Graduate Education**, and **External Affairs**, and the **Head of Faculty Administration**, who is responsible for leading the administration across the Faculty.

School of Chemical Engineering and Analytical Science

Head of School, Professor Mike Sutcliffe

School of Chemistry

Head of School, Professor Christopher Whitehead

School of Computer Science

Head of School, Professor Norman Paton

School of Earth, Atmospheric and Environmental Sciences

Head of School, Professor Hugh Coe

School of Electrical and Electronic Engineering

Head of School, Professor Andy Gibson

School of Materials

Head of School, Professor Paul Hogg

School of Mathematics

Head of School, Professor Peter Duck

School of Mechanical, Aerospace and Civil Engineering

Head of School, Professor Peter Stansby

School of Physics and Astronomy

Head of School, Professor Stephen Watts

Dalton Nuclear Institute

Director, Professor Andrew Sherry

Manchester Interdisciplinary Biocentre

Director, Professor Nigel Scrutton

Photon Science Institute

Director, Professor Richard Winpenny

University of Manchester Aerospace Research Institute (UMARI)

Director, Professor Philip Withers

Associate Dean (Research)

Professor Hugh McCann

Associate Dean (Teaching and Learning)

Professor Tony Brown

Associate Dean (Graduate Education)

Dr Ann Webb

Associate Dean (External Affairs)

Professor Colin Hughes

Head of Faculty Administration

Rachel Brealey

WELCOME FROM THE DEAN

Welcome to this first publication of the Your Manchester: Faculty of Engineering and Physical Sciences Alumni magazine. I hope you find the contents interesting and that the articles provide you with both a reminder of your time in Manchester and an indication of the wide range of work and activities that we are engaged with.

The Faculty is one of the largest in the UK, with 10,080 students and 1,950 staff across nine Schools, combining strengths in research and teaching across all of the physical sciences and engineering disciplines. Students come to study with us from across the world and we welcome just over 3,000 international students to the Faculty every year, providing a diverse and exciting mix of cultures within our leading degree programmes.

While the Faculty is very proud of its current achievements, it also has the ambition of becoming known as one of the leading Engineering and Physical Science faculties in the world. Our strategic plan lays out the route to achieving this aim, and we believe we have the staff, students and facilities to succeed in our mission. Our three primary goals cover 'Research', 'Higher Learning' and 'Social Responsibility', and we give equal esteem to each.

Based on our current performance, I believe we are already well on our way to achieving our strategic aim. Many of our staff are at the forefront of research and discovery, as evidenced by the recent award of the 2010 Nobel Prize for Physics to Professors Andre Geim and Kostantin Novoselov for their discovery of graphene, which has now become the basis of a wide range of further research and development around potential applications in materials, chemistry, physics and engineering. This potential is now being acknowledged across the globe, and we are delighted with the recent announcement by the Chancellor of the Exchequer, George Osborne, of a new £50M investment in the development of graphene in the UK – clear recognition that the Government recognises the importance of investment in science as an economic driver. Further details on

the development of graphene and the announcement by the Chancellor can be found on pages 10-11.

The Faculty considers the communication and public engagement of science and engineering to be one of its key priorities and there is further detail on our engagement with schools on pages 24-25, focusing on the numerous activities that the School of Chemistry undertakes to enthuse children to become the scientists of tomorrow. Many of our staff across the Faculty are actively engaged in public and school lecture programmes, science week events and Women Into Science, Engineering and Technology (WISSET) activities in order to encourage an understanding of the potential of our research and teaching, and to enthuse the next generation of scientists and engineers to think big!

We are particularly proud of the inter-disciplinary work that our range of disciplines and skills allow us to undertake. This work provides a significant contribution to the overall UK research offering and feeds into global issues such as energy, sustainable development, climate change, health care, advanced manufacturing and security. Staff from across the Faculty work closely with business and industry, and we are proud of the many successful research and teaching links that exist to support UK plc, the global economy and society worldwide. The feature on page 18 details the work of Manchester Energy, which brings together research and educational expertise from a wide range of disciplines to look at energy technologies and their societal impact. The research and teaching in this area includes hydrocarbon, solar, nuclear, wind and marine energy expertise, as well as looking at human impact, transport and storage, and



the environmental impacts of any energy solution.

As the Chancellor said in his speech to the Conservative Party Conference in Manchester at the start of October "Tomorrow's world is being shaped here in Manchester". We couldn't agree more!

It is clear that the higher education sector is facing challenging times, with severe and prolonged UK public funding stringency, increased fees to UK and EU students, changes to the UK immigration policy which is having an undesirable affect on the mobility of quality students, and ever-changing government policy. As a leading university, we are concerned about the impact of these proposals on students and the sector. However, we are determined to drive the Faculty forward through this period of ambiguity, to continue to improve the student experience, and to ensure that our graduates not only leave us with a high quality degree but that they are well prepared for their future careers in a global market.

I hope you enjoy this magazine, which we intend to publish every 12 months. If there are any specific areas of activity that interest you and you would like to hear more about, or if you would like to be more engaged and involved with the Faculty and the University, we would love to hear from you.

Professor Colin Bailey
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Faculty of Engineering & Physical Sciences
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LAUNCH OF THE RESEARCH CENTRE FOR RADWASTE AND DECOMMISSIONING

The Research Centre for Radwaste and Decommissioning (RCRD) officially opened in November with a launch event attended by delegates from academia, industry and commerce.

The Centre is a major research investment for the University and the Faculty, and will focus its work on geosphere/biosphere, engineering, and materials aspects of nuclear waste disposal and nuclear decommissioning. The demand for safe, long term solutions to handling the UK's complex nuclear legacy, a result of 50 years of nuclear power generation, is a driving force for research within the Centre.

Researchers began working on projects within the Centre during 2010, and have already attracted more than £5 million of research funding for major projects. These include research into the safe storage and disposal of radioactive waste, which will inform and underpin the safety case for a deep geological disposal facility; as well as decommissioning aspects of the UK's existing legacy of nuclear power stations and other installations that contain radioactive contamination.

The launch event also coincided with the opening of a new laboratory suite where state-of-the-art research with radioactive and biological materials will take place.

Researchers working in the new Radionuclide Biogeochemistry Labs



Ex BNFL Group CEO Michael Parker officially opened the new Centre for Radwaste and Decommissioning with Professor Richard Patrick, Director of the Centre. They are pictured here with speakers from the launch including Dame Sue Ion and Professor Colin Bailey.

The 'Radionuclide Biogeochemistry Laboratories' were funded by the University as part of its investment in the RCRD and provide a state-of-the-art facility to study the chemistry, biology, and geology of radionuclides.

Professor Katherine Morris, Research Director of Geodisposal at the Centre commented: "It is important to recognise that nuclear waste disposal and decommissioning are major challenges for society, and we are delighted with the successes of the RCRD over the last 12 months."

"We very much look forward to forging new links with partners in industry and academia which is essential both to address these most complex of tasks and to gain public confidence in our research activities."

The Centre is already looking to the future, and has identified priority areas, which include continued and increased dialogue and partnerships with industry, exploiting the opportunities available through calls from the Nuclear Decommissioning Authority and the UK research councils, and further collaboration within an interdisciplinary framework.

www.rcrd.manchester.ac.uk

Delegates enjoyed networking and a lively poster session before touring the University's nuclear facilities



CLEAN, GREEN TECHNOLOGY IS A STEP CLOSER WITH BIONEXGEN



will work in partnership to enable industry to use biotechnology to replace fossil fuel derived manufacturing methods.

BIONEXGEN (Developing the Next Generation of Biocatalysts for Industrial Chemical Synthesis) is an ambitious European research programme that will develop the next generation of biocatalysts to be used for eco-

efficient manufacturing processes in the chemical industry.

This three-year European Union fund project is led by Professor Nick Turner, Director of the Centre of Excellence for Biocatalysis, Biotransformations and Biocatalytic Manufacture (CoEBio3) at The University of Manchester.

A collaboration by leading European industrial and academic partners has identified a new generation of biocatalysts that, once developed, could

lead to economic and environmental improvements in the manufacture of everyday chemicals such as pharmaceuticals and polymers.

Biocatalysts are enzymes, or microbial cells containing enzymes, that can carry out chemical reactions. Routes to specialised, high-value products often require long chemical synthetic routes involving complex reaction steps with toxic side products and waste streams. This project will allow these methods to be replaced by clean biocatalysis routes using renewable resources.

Professor Nick Turner said: "I warmly welcome all the partners to the programme and look forward to collaborating with them in this exciting field of interdisciplinary science. The research was devised with the close involvement of industrial partners; this is a great strength of the programme and will ensure real-world application of the green chemical processes developed."

www.coebio3.org

GRAPHENE IS A HIT WITH THE KIDS

The University took graphene to the 2011 Royal Society Summer Science Exhibition in July. The free exhibition allowed the general public to interact with cutting-edge science, and to question UK scientists about their research.

The 'Graphene: unexpected science in a pencil line' exhibition gave visitors the chance to build their own two-dimensional materials using models, make graphene, and see atoms on a virtual electron microscope.

Smartphone users have also been able to download 'graphene: the app' - a free application which contains three games about graphene. The games were developed for the Royal Society Exhibition.

Dr Ian Kinloch, a lecturer at the University, was on hand to help guide visitors through the graphene exhibition. He said: "All the University students and staff had a fantastic time telling people about their work on graphene. The visitors to the stand were very interested and asked lots of questions. They really enjoyed repeating the original Nobel Prize winning experiments to make their own graphene flakes."



Professor Novoselov explains graphene to the Royal Society exhibition visitors

SCHOOL OF ELECTRICAL AND ELECTRONIC ENGINEERING TOPS THE SUNDAY TIMES' LEAGUE TABLE



The Sunday Times University League Table has listed The University of Manchester's School of Electrical and Electronic Engineering as the number one ranked electrical and electronic school in the UK for 2012.

The league table ranks institutions using eight criteria: student satisfaction, teaching excellence, peer assessments, research quality, A-level/higher points, employment statistics six months after graduation, firsts and upper second class degrees (2:1) awarded and dropout rate.

The School was delighted with the vote of confidence from its graduates in the National Student Survey (NSS) with 96% student satisfaction for the courses it offers, making it the top Russell Group University in the subject area.

The School also performed well in the most recent Unistats survey. Unistats is the official website used by students to make an informed choice when deciding which UK university or college to apply to. Its score in 'assessment and feedback' was the highest ever achieved by any university in this discipline area.

Professor Andrew Gibson, Head of School, said: "Being placed at the top of The Sunday Times' league table is a great result, and a fantastic expression which rewards the hard work carried out by staff and students within the School. Our innovative teaching, and continued collaboration with industry, allows us to work on cutting-edge projects that are addressing real challenges within electrical and electronic engineering."

GREAT LEAPS IN THE TIMES HIGHER EDUCATION UNIVERSITY RANKINGS

The University and the Faculty of Engineering and Physical Sciences have seen their rankings continue to climb in the most recent Times Higher Education (THE) world university rankings.

The THE world university rankings takes into consideration 13 performance indicators in five categories - teaching, research, citations, industry income and international outlook - to assess the

position of universities worldwide, in what it calls the "gold standard" in international university performance comparisons.

As well as producing a 'world top 200 rankings' list, the THE Supplement compiles six tables to show the best 50 institutions by subject. For 2011/12 the University jumped to 48th (from 87th last year) in the world. In Engineering and Technology, the University is now

positioned 26th in the world, and 46th for Physical Sciences.

Professor Colin Bailey, Vice-President and Dean of the Faculty of EPS commented; "The Faculty continues to improve its international standing. It is important that we build on this foundation and ensure that the Faculty reaches the top standing in excellence globally that we are capable of achieving".

MANCHESTER CONTINUES TO PRODUCE THE BEST CHEMICAL ENGINEERS

Rachel Perry, a 2011 graduate from the School of Chemical Engineering and Analytical Science (CEAS) has scooped the top honour of 'best chemical engineering student of the year'. The prestigious AWE award was presented to Rachel at the Science, Engineering and Technology Awards (SET) in September.

The SET awards are billed as the most important awards for science and technology undergraduates, and aim to showcase the groundbreaking work undertaken by students within the UK. Supported by industry and academia, the awards provide a showcase for education excellence.

This is the second consecutive year that a University graduate has been named as best Chemical Engineering student in the country, with Dyfan Williams' success in 2010.

The judges were impressed by Rachel's final year design project, 'biobutanol and acetone product purification by distillation', which was an effective and affordable process for purifying

biobutanol, producing a marketable renewable transport fuel.

Rachel is no stranger to awards, having already won a Shell Scholarship, the BP Book Prize, The Crosfield Prize and the Course Prize - all before she graduated. She also graduated with a 1st class honours degree. Rachel said: "I'm indebted to everyone who supported and assisted me throughout my degree, both the staff and my fellow students.

"I am honoured to have received this award and I hope I will go on to make The University of Manchester proud."

Rachel is currently working at the ExxonMobil Fawley refinery as a graduate process engineer.

Professor Mavituna, who nominated Rachel for the award, remarked: "Rachel's individual design project on the



purification stages of a biobutanol process showed her excellent analytical and synthetic skills and went above and beyond what we expected.

"It is an excellent example of a design project achieved only by the best students. Rachel displays all the qualities needed to become a highly-successful engineer."



ROYAL SOCIETY RECOGNITION FOR UNIVERSITY POSTGRADUATE STUDENT OF THE YEAR

Postgraduate research student Paul Bassan, from the School of Chemical Engineering and Analytical Science (CEAS), has won the University Distinguished Award for the Postgraduate Student of the Year 2011.

Paul's work "The scattering of IR radiation from biological cells and the development of a correction algorithm to remove the effects of resonant Mie scattering from IR spectra" has had a profound effect within biomedical IR spectroscopy, as it has paved the way for the analysis of infrared spectra of biological cells without distortion, allowing it to be interpreted in terms of the biochemistry.

The Royal Society of Chemistry has acknowledged Paul's groundbreaking research with the award of its 2011 Royal Society of Chemistry (RSC) Ronald Belcher Award for Analytical Chemistry. The annual award recognises innovative, analytical research by a graduate of a British or Irish university, and is sponsored by the Analytical Chemistry Trust Fund.

Paul said: "I am honoured to have received the awards I have won this year. My success is due to the support of a number of great scientists, and I must thank my supervisor Peter Gardner, and collaborators Joe Lee and Achim Kohler".

**MSc IN PROJECT
MANAGEMENT
GOES GLOBAL**



The University has signed a memorandum of understanding with Nanyang Technological University (NTU) in Singapore, to offer a major boost to the next generation of project managers.

Launched in 2000, and developed in partnership with Rolls Royce, the course gives project managers the specialist skills that are required by the engineering industry. The course is currently delivered by the University's School of Mechanical, Aerospace and Civil Engineering (MACE), and at Penn State University in the US. The addition of NTU will bring the course to a wider engineering audience.

Among those who can benefit from the course are engineering professionals, engineers and project managers, and the skills it delivers are applicable across a wide range of engineering sectors. The first intake of 20 students will take place in 2012.

Professor Andrew Gale, Course Director and Leader of the MACE Management of Projects Research Group commented: "My colleagues and I are very proud to have the opportunity to collaborate with NTU and to have such a facilitative relationship with Rolls-Royce".

Jonathan Asherson, Rolls Royce Regional Director - South Asia, added: "We have a long-standing, successful partnership with The University of Manchester and, therefore, we are confident that this collaboration will be a success. With our growing customer base in Asia, it makes sense for us to extend the global network offering the MSc in Project Management".

**INTERDISCIPLINARY RESEARCH GETS A BOOST
WITH INDUSTRIAL COLLABORATION**

The University's already successful partnership with international chemical firm Solvay SA has been given a boost by a major new collaboration to develop novel materials for use in healthcare, sensors and as biocatalysts.

The additional £1.4 million funding from Solvay SA will allow the University to accelerate new projects across the Faculty of Engineering and Physical Sciences, and will be utilised over the next four years.

The funding will be used to push forward research to develop new organic material for innovative sensor and electronics applications, with input from academics from across several schools in the Faculty. Projects include research to find new materials to replace worn out body parts, developing innovative biomaterials for use in regenerative medicine, and the development of biocatalysts. It will also



From left: Mike Sutcliffe (Head of CEAS), Eileen Diaken (Solvay), Ern Edmonds (Solvay), Cathy Merry (Materials), Colin Bailey (Vice President and Dean, EPS), Aline Miller (CEAS & PI), Mike Turner (Chemistry), Wafa Mousa (Solvay), Johannes Eicher (Solvay) and Laurent Jeannin (Solvay)

be used to drive the development of new materials and sensors for application in environmental monitoring, homeland security, healthcare, medicine, and the development of leading-edge biocatalysts.

**INNOVATIVE SMART
GRID TECHNOLOGIES**

The School of Electrical and Electronic Engineering recently hosted the second European conference and exhibition in Innovative Smart Grid Technologies (ISGT). The event took place at Manchester Central Convention Complex during December 2011.

The event was sponsored by the IEEE Power & Energy Society - a worldwide, non-profit association of more than 28,000 individuals engaged in the electric power energy industry. Alstom Grid,

Electricity North West, Siemens and Wipro also supported the event.

Smart grid technology aims to predict and respond to the behaviour of consumers within the electricity network in order to provide more sustainable energy, and the conference is bringing together international experts to address and discuss the state-of-the-art technologies.

Delegates from more than 40 countries attended to hear about the latest smart grid technology research and applications, in keynote speeches, debates and interactive sessions which were delivered by leading academics and industrialists.

Peter Crossley, Professor of Power Systems, and technical programme chair, said: "This was the most important conference in Smart Grids in Europe in 2011. ISGT Europe is unique in that it answers requirements on every level, from manufacturers to consultants, utilities to academics".



ROYAL STAMPS OF APPROVAL FOR JODRELL BANK



Above, the Jodrell Bank 1st class stamp.

Left, Professor Brian Cox, Professor Dame Nancy Rothwell and HRH Prince Andrew, Duke of York take a tour of Jodrell Bank.

Central among these is the Square Kilometre Array – the world's largest telescope – whose headquarters will be based at Jodrell Bank. The Prince praised the impending arrival of the SKA headquarters, and commented: "It will be a really fundamentally big project and most of the work is being done at Jodrell Bank."

HRH Prince Andrew, Duke of York, visited Jodrell Bank in October as part of a tour of science and innovation centres in the North West.

Jodrell Bank Observatory has been observing space since 1957, and is still one of the most powerful telescopes in the world. As well as a UK centre for astronomical research it is an important visitor attraction, and boasts a recently refurbished Discovery Centre, which gives the public an insight into the work of the observatory and its research teams, and aims to inspire young scientists.

Accompanied by Professor Dame Nancy Rothwell, President and Vice-Chancellor of the University, and Professor Brian Cox, the Prince took the controls of the world-famous Lovell Telescope and took a tour of the new Discovery Centre and grounds. The Prince also planted the first tree in the new Sustainable Forest Garden.

He later met with several of the University's leading academics to consider the future of UK science and the challenges that lie ahead, and to discuss new and existing research projects at Jodrell Bank.

Jodrell Bank has also recently been chosen by Royal Mail Stamps to represent the letter 'J' in a new set of stamps. The stamps feature an A to Z of UK iconic landmarks, taking a fresh look at some of the country's most famous sights.

Dr Teresa Anderson, Director of the Jodrell Bank Discovery Centre, said: "We are delighted that Jodrell Bank has been recognised as the iconic 'J' in the new 'A to Z of the UK' stamp issue. Jodrell Bank is a major UK landmark, and also carries out world-leading research in astrophysics which makes it a very special place".

www.jodrellbank.net



The winning image
Fresh light on the past
 Dr Lindy Crewe

During summer, staff and students in Archaeology excavate at the Bronze Age village of Kissonerga-Skalia in Cyprus. We want to understand how people interacted with each other and their environment 4,000 years ago, and to communicate to people today that learning about the past can help us better manage the future. Archaeology is a finite resource, irreplaceable once destroyed, so we have a responsibility to dig, and record our discoveries, carefully. On the final day we photograph for publication: sweeping trenches clean, clearing archaeologists from the frame. Like past peoples we are often creative in our use of tools, such as duct-taping a camera to a telescopic window-cleaning pole to take this photograph. Many attempts are needed to get the shot straight (this is one that failed) and it's a race against the rising sun. We then backfill to protect the archaeology from winter rains, awaiting our return next summer.

IMAGES OF RESEARCH BRINGS SCIENCE CLOSER TO THE PUBLIC

Bringing scientific research to a wider audience is a major part of the University's vision, and the recent Manchester Science Festival, which took place in October, allowed us to do just that.

The University played host to a fun packed programme of family science shows, hands on activities, public talks, debates, science busking, and a unique event capturing scientific research through images.

University researchers from across all disciplines were given the chance to share their work with the general public by using a single image of their work to convey its diversity and breadth. The public were asked to nominate their favourite image.

Through the themes of 'people', 'culture' and 'environment', researchers captured some breathtaking images of their work or their experience of conducting research, which were teamed with short explanations for a non-specialist audience.

The competition aimed to bring the University's work to a wider audience, and show how it has a direct impact on the general population. The competition entries were displayed at the John Rylands Library Deansgate to engage with a range of audiences in a non-university setting.

The competition tied in with The Manchester Science Festival, and allowed the University to tap into the thousands of visitors who came to the Festival.

Many of the competition entrants attended a Science Spectacular, which was hosted at Whitworth Hall and Manchester Museum, to meet with the public and talk about the research behind the image. More than 2000 visitors came to the Spectacular in a single day, with many family groups of all ages and backgrounds, ensuring the research photography was shared and communicated even more widely.

Professor Colin Hughes, Associate Dean for External Affairs in the Faculty, commented: "The combination of a visual element and story provided a powerful medium for communicating our research. The competition was about exciting interest, about being creative, and about getting our researchers and the public to think about the research in a different way. It also provided an opportunity for researchers from different disciplines to talk to each other and to extend that conversation beyond academia."

The overall winning image came from Dr Lindy Crewe from the School of Arts, Histories and Cultures, with her inspiring 'Fresh light on the past' image.

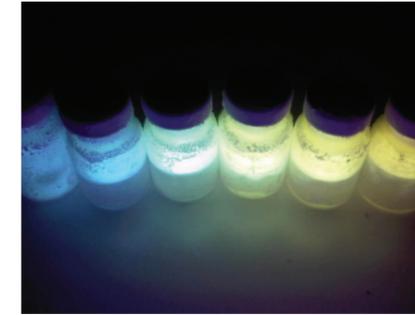
Researchers from the Faculty of Engineering and Physical Sciences exhibited inspiring images of some of their research. Their shortlisted photographs and brief descriptions of the research they illustrate are featured above and right along with the winning image. All the shortlisted images are available on the Images of Research website.

www.manchestersciencespectacular.co.uk



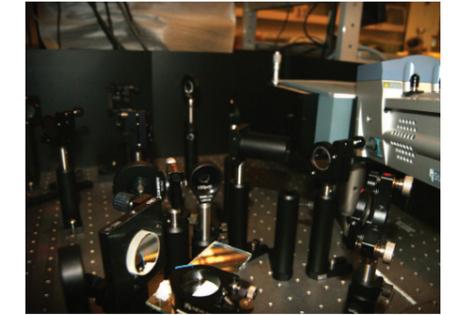
Aircraft Contrails
 Dr Antonio Filippone

Contrails are vapour trails released by aero engines as they cruise in the high atmosphere. They are the cause of medium- to long term climate change, as they generate considerable cirrus clouds and contribute to the reduction of the night-day temperature difference (warmer nights, colder days). This is a problem in NW England, where a combination of temperatures, atmospheric humidity and commercial aviation conspire to create worrying levels of artificial clouds. The photo shows various levels of contamination and wake age. The sharpest clouds have just been released (a few seconds old); the oldest clouds are about 20 to 30 minutes old. An airplane is seen just through the tree on the right.



Clean green light
 Jon Fellows

The manufacturing of technology has never been thought of as a clean process, requiring dangerous chemicals and harsh conditions. One cutting-edge area is exploring the application of 'quantum dots', crystals that are a billionth of a meter in size, to everything from next generation televisions to cancer treatment. The bottles in this image contain quantum dots that have been made in a new, 'green' way: they have been made by bacteria. Bacteria have been making these tiny crystals for millions of years as a defence against toxic chemicals in the environment, and my research has been searching the environment for bacteria that can be used to mass produce these quantum dots: a cleaner, greener, more environmentally friendly alternative. And these bacteria don't require the expensive and dangerous chemicals that would otherwise be necessary; they can make them whilst cleaning up contaminated land.



Shedding light on H²O
 Francis Lydiatt

Corrosion or 'rusting' costs the UK over £60 billion or 4% of its Gross National Product (GNP) every year, and is key to the lifetime of many essential structures such as bridges, power transmission towers and wind turbines. The [above/adjoining/following] photograph shows part of an experiment that uses powerful laser light and some sneaky science to look at the small-scale behaviour of water molecules on metal surfaces. Oddly enough, the smaller the thing you're trying to look at, the bigger and more complicated your experiment tends to be! A better understanding of how water and other molecules from the atmosphere behave on metals will lead to better corrosion prevention techniques (paints, coatings, surface preparations etc.) thus saving the UK lots of money annually and meaning our pipes and pylons will be healthy and functional for many more years to come.



Can electricity be clean and cheap?
 Muhammad Ali

Do you see a difference? On the left is a coal power plant injecting plume of harmful gases in the air while on the right is a wind farm operating without any impact on the environment. Both produce electricity that we use every day in our houses, offices, shops factories, and industries. The difference is how this electricity is produced and which option is cheaper. Wind farms are harmless for the environment and do not deplete natural resources as their fossil-fuel dependent counterpart. But are they as cheap? The aim of our research is to identify factors that reduce production of electricity from wind farms. Once these factors have been spotted they can be improved and wind farms can become an economically attractive option for investors. It is hoped that this research will not only be useful for wind farm developers but also indirectly contribute towards a cleaner environment.



What lies beyond your plug socket?
 Laurence Stamford

We rarely think about where our electricity comes from – we flick a switch and a light comes on – but our power has a history. 88 million cubic metres of gas are burned for electricity in the UK every day – enough to fill 880 Royal Albert Halls. 80 trainloads of coal meet the same end. And it isn't just a fossil fuel problem: a single offshore wind turbine contains over 400 tonnes of steel, with all its associated manufacturing. Using Life Cycle Assessment, we can map out everything required to generate electricity, from the mining of fuels and materials to the decommissioning of power plants. This lets us find the real impacts of different power sources in terms of climate change, acidification, ozone layer depletion and other environmental problems. Electricity consumption is soaring, and present-day policy decisions will affect us for decades, even centuries, making this knowledge more vital than ever.



Electronic waste – consumers' behaviour and environment
 Azadeh Dindarian

The rapid growth in the electronics sector and use of technology in general has inevitably resulted in the generation of vast amounts of waste in the form of electrical and electronic equipment. These wastes are often highly complex, integrated and toxic and consist of valuable substances such as gold and copper. The researchers at the University of Manchester teamed up with CREATE a charity and social business and developed a research program to determine the reasons why people discard electronic products and what are the factors, in particular microwave ovens, washing machines and tumble dryers and their functionality at the point of disposal. We hope to answer followings: the reasons electrical products are discarded, solutions to extend the life span of these products, either by extending their initial life span or by re-using and re-manufacturing them and the implications of such life span extension for society and the environment.



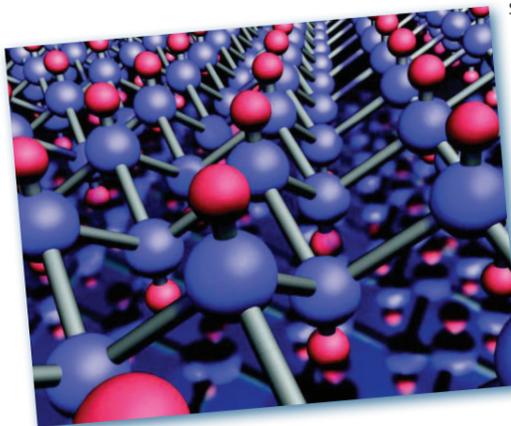
Pictured left, from the left: Professor Konstantin Novoselov, Professor Andre Geim and Professor Dame Nancy Rothwell with David Willetts, Minister for Universities and Science and Chancellor of the Exchequer, George Osborne

NATIONAL RESEARCH PROGRAMME FOR GRAPHENE AT MANCHESTER

The race to turn the Nobel Prize winning research on graphene into commercial success was given a boost during October, with an announcement from the Chancellor of the Exchequer, George Osborne MP.

During a visit to the University the Chancellor of the Exchequer outlined the Government's commitment to supporting UK world-class research through the creation of a Graphene Global Research and Technology Hub with the aim of commercialising graphene. The announcement is part of a £200 million investment into UK science.

In his speech at the Conservative Party Conference, which took place in Manchester during October, the Chancellor talked of his delight in visiting the University, and of his pledge to "get Britain making things again". He said: "We will fund a national research programme that will take this Nobel Prize winning discovery from the British laboratory to the British factory floor".



Graphene, first discovered at The University of Manchester in 2004, is the thinnest and strongest material ever to be found, and is referred to as 2D atomic crystals. The crystals can be seen as individual atomic planes 'pulled out' of bulk, 3D crystals.

Although only one atom thick, graphene is stable under ambient conditions, which allows it to be considered as a viable material in ultrafast electronics making them cheaper to

produce, faster, thinner and more flexible. Research into its applications is already underway.

Professor Andre Geim and Professor Konstantin Novoselov were awarded the Nobel Prize in Physics in 2010 for their groundbreaking experiments and discovery of graphene.

The announcement of the new Hub means researchers at Manchester can continue their groundbreaking work into developing and applying graphene. Many

// We will fund a national research programme that will take this Nobel Prize winning discovery from the British laboratory to the British factory floor. //

George Osborne MP

organisations are currently working on research, development and applications for graphene, and during summer 2011 Professor Andre Geim talked of his desire to see continued research into graphene take place in the UK, and specifically Manchester. He said: "I do wish that more of the current research was happening in the UK."

The development of the Hub will act as a catalyst to spawn new businesses, attract global companies and translate the value of scientific discovery into wealth and job creation for the UK. The Hub will also enable the development of technology to allow manufacturing on a large scale which would open up commercial opportunities, as well as providing doctoral training and advanced research equipment.

// Graphene is one of the most important scientific advancements in recent times. //

Professor Dame Nancy Rothwell

Professor Dame Nancy Rothwell, President and Vice-Chancellor and of the University, commented: "The announcement is fantastic news for the University, and fantastic news for the city of Manchester.

"It is extremely important that the UK government clearly recognises the importance of investment in science as an economic driver.

"Graphene is one of the most important scientific advancements in recent times. We are proud of the world-class research carried out here, and to have that recognised by the Government is a real vindication of the work we do."

When asked for his reaction to the news of the Graphene Global Research and Technology Hub, and the Government's commitment to its research, Professor Geim said: "It's important that this Government realises the fundamental importance of science and, even in this economic climate, finds the extra money.

"The University of Manchester has been at the forefront of graphene research since 2004, and we plan to be there for a long time to come."

A full business case for the Hub is being developed by the Engineering and Physical Sciences Research Council (EPSRC) in partnership with the Technology Strategy Board.



GRAPHENE TIMELINE

2002
GEIM APPOINTED AS DIRECTOR OF MANCHESTER CENTRE FOR MESOSCENCE AND NANOTECHNOLOGY

2004
GRAPHENE DISCOVERED

2007
GEIM ELECTED AS A UK ROYAL SOCIETY FELLOW

GEIM AWARDED THE MOTT PRIZE FOR THE DISCOVERY OF A NEW CLASS OF MATERIALS, PARTICULARLY GRAPHENE

GEIM APPOINTED AS LANGWORTHY RESEARCH PROFESSOR, PREVIOUSLY HELD BY LEADING NAMES IN PHYSICS INCLUDING RUTHERFORD, BRAGG AND BLACKETT

2008
GEIM AND NOVOSELOV AWARDED THE EUROPHYSICS PRIZE FOR DISCOVERING GRAPHENE

NOVOSELOV NAMED AS ONE OF THE UNIVERSITY'S RESEARCHERS OF THE YEAR

2009
GEIM RECEIVED THE KORBER EUROPEAN SCIENCE AWARD

2010
GEIM AND NOVOSELOV AWARDED THE NOBEL PRIZE FOR PHYSICS

GEIM AWARDED A ROYAL SOCIETY 2010 ANNIVERSARY RESEARCH PROFESSORSHIP

2011
UK ROYAL SOCIETY ELECTS NOVOSELOV AS A FELLOW

THE CHANCELLOR OF THE EXCHEQUER, GEORGE OSBORNE ANNOUNCES THE GOVERNMENT'S COMMITMENT TO SUPPORTING UK WORLD-CLASS RESEARCH THROUGH THE CREATION OF A GRAPHENE GLOBAL RESEARCH AND TECHNOLOGY HUB



Daniel, left, in Yoomoo with wife and business partner Amanda, business partner Samantha Pyser and Operations Director Peter Dowding

DANIEL GESTETNER

Daniel Gestetner came to UMIST to study Textile Technology and Management in 1989. After a varied and successful business career, he set up Yoomoo the UK's leading frozen yoghurt company last year.

On graduation he landed a place on the management training scheme at Tesco. "The scheme at Tesco is brilliant and I got some phenomenal training there. They throw graduates right in at the deep end. I was put straight onto the shop floor, in a suit, in charge of 30 people some of whom had been there for years."

Gestetner made quick work of the scheme, completing the two-year programme in just a year, then climbing swiftly up the management tree. By the time he left Tesco in 1995 he was cake buyer for the whole company, the youngest buyer ever, controlling a budget of £40 million at the tender age of 24.

From Tesco he progressed to Revlon, running marketing in Central and Eastern Europe before a period in New York working alongside the CEO. In 1999 he decided it was time to set up his own venture. "I think there's great value in working for other people and organisations before you set off on your own business journey. I'd had seven years of learning from other businesses. It was time."

Daniel launched Shopsmart with his brother Leo, a price comparison website before most people had heard of such sites. Right at the forefront of the industry and riding the wave of the dotcom boom

// There's great value in working for other people and organisations before you set off on your own business journey. //

it was a very exciting time. "We were pioneers in the industry, getting lots of attention. In 2000 we were about to float the company for half a billion, but a week before the deal went through the bubble burst." Shopsmart survived but the £100 million Daniel was personally due to make on flotation wasn't to be. The company was sold to Barclaycard in 2001 and the Gestetners moved on. "I didn't want to stay on at Shopsmart as I knew by then that I couldn't go back to working for

someone else, so Leo and I set up Brands etc. in 2002."

The new company was a vehicle to buy, sell and actively manage brand-driven companies. In seven years to 2009 they acquired and transformed Zoggs, the swimming brand; Fiorelli handbags and accessories; Myla the luxury lingerie company; and the Fit Co, top end sportswear and equipment website and store.

What does Daniel look for when searching for investment opportunities? "I look for companies that are interesting and innovative, I'm not interested in 'me-too' companies. I'll look for size, scalability and market position. You might come across a company that looks cool, but if it can only generate margins of 8-10% there's no point in looking any further. There must be innovation, entrepreneurial spirit and the potential for exponential growth."

"Zoggs is now four times bigger than it was when we bought it, the Fit Co has grown unrecognisably, all of our companies have."

// Being 'a Gestetner' has definitely given me my entrepreneurial drive and desire. //

The brothers went their separate ways in 2010 when Leo moved to LA. Far from being put off setting up a business with a family member, Daniel looked even closer to home and last year launched frozen yoghurt company Yoomoo with his wife Amanda along with another business partner. "We saw that the frozen



yoghurt business was booming in the US so decided to set up here in the UK." Not surprisingly the funky company is growing fast. After only a year of trading Yoomoo is the top UK frozen yoghurt brand. There are 11 Yoomoo outlets (and counting), the latest one opened last month in the brand new Westfield shopping mall in Stratford. They've also clinched an exclusive deal with Harrods and a supermarket line is on its way.

How do the Gestetners manage their business/family balance? "We have to be strict about setting boundaries. We make a point of saying 'we're not going to talk about business this evening'. We can manage it, but only for about three hours! Our kids get involved too. They are seven, nine and 11 and are great consumers! They have opinions and ideas about new flavours and combinations. It helps that they really love the brand."

Family has always been important to Daniel's business identity. "Being 'a Gestetner' has definitely given me my entrepreneurial drive and desire. And a sense that anything's possible. My great grandfather had nothing when he left Hungary for the UK (via the States), but he had a great idea. He invented the photocopier. My grandfather and father built the company up to having 40,000 staff and operating in 177 countries when it was sold thirty years ago. My son unveiled a blue plaque for my great grandfather in North London just this summer. That was a very proud moment."

The entrepreneurial gene is alive and kicking in Daniel Gestetner and his passion and excitement for business shows no sign of dimming. "I learnt quickly at Tesco that you get out of life what you put in. I certainly didn't have a road map when I began. As long as you've got a clear medium term goal, you can afford to be creative and flexible about how you get there. That's the fun part."

A HELPING HAND FOR TALENTED STUDENTS



Talented chemistry student David Cummings would have struggled financially without the Opportunity Manchester Scholarship

Assisting talented students, whatever their background or circumstances is a major goal for the University, and for the Faculty of Engineering and Physical Sciences. The University's 'Manchester 2015 Agenda' aims to make Manchester the UK's most accessible research intensive university by 2015, and the Faculty works hard to raise awareness of the science, technology, engineering and mathematics (STEM) opportunities and qualifications. It works with children, teachers and parents to promote applications from the most gifted and talented students, regardless of social status, geography or ethnic grouping.

Our alumni play a major role in ensuring the Faculty reaches such students, by offering financial help to gifted and talented individuals who may not have considered a university education.

OPPORTUNITY MANCHESTER SCHOLARSHIP

The University-wide Opportunity Manchester Scholarship was established in 2007, and is awarded to students from the Greater Manchester area who have proven their academic talent through exceptional A-level results, and outstanding performance at University summer schools, workshops and academic assignments. In 2010, 70.6% of Opportunity Manchester Scholarship students obtained a first class or upper second class degree.

There are currently 59 students in the Faculty of Engineering and Physical Sciences in receipt of an Opportunity Manchester Scholarship. David Cummings, who is studying for a BSc in Chemistry with industrial experience, is one such student. The Scholarship was a deciding factor in his choice to continue onto higher education, "Without the scholarship I would struggle to keep up with the financial demands of higher education and, as a student who gained three A grades at A-level, it would be a shame for me to not reach my full academic potential due to financial problems. Without the Scholarship I most likely wouldn't have attended university".

EQUITY AND MERIT SCHOLARSHIP PROGRAMME

The support of our alumni has been key in establishing the Alan Gilbert Equity and Merit Scholarship Programme, which gives students from some of the poorest

countries the chance to join Manchester to study for a master's degree.

The Programme supports students from developing countries, including Uganda, Rwanda and Bangladesh, where postgraduate study can be an unachievable dream.

Students are equipped with the skills required to tackle major developmental issues in their home countries, and have included: Electrical Power Systems Engineering, Textile Technology, Structural Engineering, Advanced Chemical Process Design, and Chemical Engineering.

Since the Programme began in 2007, 272 students have benefitted from a Manchester education, either by studying on campus, through distance learning courses, or through accreditation of courses in their home countries.

Richard Odoch is currently studying in Manchester for an MSc in Maintenance Engineering and Asset Management. At home in Uganda he works as a production manager for a coffee manufacturing company. He's already made plans for how he can put his new skills to use in Uganda after his graduation: "My immediate aspiration is to become a professional maintenance engineer, and in the future to become a consultant turnaround manager, working with companies to design and implement turnaround strategies to increase their productivity and profits.

"I am extremely grateful for this opportunity and having heard from past recipients of this award, I'm more than convinced that its goals are being achieved. As a result I would like to encourage others to keep the Scholarship going. Right now it's just a snowball, but in a few years' time it could be an avalanche."

THE IMPACT OF SCHOLARSHIPS AND DONATIONS

Many of our alumni choose to support the University by providing a financial gift. Alumni giving makes a real difference to the University by providing it with the financial flexibility to provide strategic support for outstanding students, teachers and researchers.

Alumnus George Rigg has a passion for physics, and requested that his donations be used to fund a particle physics postgraduate student.

George Rigg graduated from the University in 1960 with a BSc Science, after which he continued his studies at the University of California. He began his professional career with English Electric Aviation (now BAE Systems) where he helped to design missile guidance systems.

He has worked on the US space programme, developing process control and ground equipment computers, as well as within Signetic Semiconductor (now Philips), and was the first member of a new management team to turn around Microchip Technology, Inc. in Arizona. He retired in 2001, and is an active member of the North American Foundation for the University of Manchester (NAFUM). He was awarded the University Outstanding Alumnus Award 2007.

George currently funds the Rigg-NAFUM PhD Scholarship in Energy, the Environment and Sustainability, which aims to build strategic links between the University and leading research institutions in the USA.

When asked about his time studying at Manchester, George recalls: "My memories are of grey clouds, cold rain, more rain and warm people, teamed with a strong sense of being part of an historic, exciting and great university.

George adds: "I remember a lecturer in a physics class who brought in a tape recorder, asked for silence while demonstrating two 'pings' eight minutes apart, and said "that was the first radar echo from Venus". That inspired me, and gave me a lifelong interest in, and occasional contribution to, various space exploration programmes".



George Rigg receiving a medal at the University for Outstanding North American Alumnus in 2007

George's main motivation to support postgraduate research comes from his strong pride in, and warm affection for, the University. He said: "With retirement has come an active involvement in NAFUM and renewed contact with the University. This in turn has reinforced my wish to 'give back' in a structured and productive way. Initially this support was for a scholarship in physical sciences, and is currently to support research in particle physics".

The current recipient of George's generous support is Terrance Figy, who is undertaking research in particle physics and cosmology, focusing on creating programmes investigating the elusive Higgs boson at the Large Hadron Collider (LHC) at CERN. He commented: "This Scholarship will have an enormous impact. It provides the necessary support for me to connect with high energy physics groups from around the world, and gives me direct contact with experimental particle physicists who work at The University of

Manchester. This will aid my research in the area of theoretical particle physics.

"I have only recently begun my PhD so have not yet had the opportunity to meet with George, but I hope to do so I can express my appreciation for his support."

Finally, when asked for his opinion on alumni contributions, George resolutely replied: "It seems that human progress is heading into an era of ever faster change, far higher complexity, explosively growing communication and greater danger. At the same time, governments have overspent scarce resources, and are increasingly limited by gridlock and bureaucracy.

"As governments invest less in breakthrough research and funding student access to universities, there is a growing need for increased alumni support of the universities that launched, or accelerated, their careers".



Equity and Merit Scholarship recipient Richard Odoch plans to put his skills to work back in Uganda after he completes his MSc

THE REAL IMPACT OF SCHOLARSHIPS AND DONATIONS



Keith Maddocks in his lacrosse kit

Keith Maddocks graduated from The University of Manchester in 1959 after gaining a BSc in Science, and went on to complete an MSc with the support of a scholarship from Shell.

He has fond memories of his time at the University and says: "I remember how friendly the lecturers and Professor Jack Diamond were compared to the teachers at school. I played lacrosse for the University having learned the game at Heaton Moor Council School before the 11 plus. I have to say that the Rag Ball sits high in my memory as it caused a delay of 12 months in my degree".

Engineering was close to Keith's heart from an early age, and he was sure he wanted to continue studying at a higher level. He recalls: "As a child I had a strong interest in engineering and my degree improved my chance of getting a good job in that field. Also, understanding the theory as well as practice increased my confidence".

He formed KMG Systems Limited during the 1970s, and the company is a major supplier of specialised conveying systems to food manufacturers around the world. The company has built its reputation on finding novel approaches to engineering challenges by designing, manufacturing and patenting machinery for the food industry, inspired not least by Keith's thirst for addressing engineering challenges. Before he embarked on his successful career he spent many hours at his kitchen table, trying to work out how he might improve the performance of a hydraulic actuator.

Keith now works with the University to offer financial support to students. The aptly-named 'Maddocks Scholarship' in the School of Mechanical, Aerospace and Civil Engineering provides support towards

the costs of studying for a PhD for the duration of the programme. When asked why he decided to get involved in helping students, he said: "I have only good memories of the University and remember with gratitude the funding I received from Shell to complete an MSc. I am now in a position to help other engineers on their way and this is the reason for the scholarship".

Gareth Roberts is the current beneficiary of the Maddocks Scholarship. His project is working towards developing the application of unmanned aerial vehicles for civilian use. Although currently used in the military, Gareth's work is exploring their use in border and coastal patrols, and aerial surveillance in emergencies such as woodland fires and floods. New uses will require adaptations to existing design, such as morphing of their wings and/or control surfaces to achieve greater flight efficiency and less fuel burn.

And through meeting the recipient of his financial support, Keith feels his donation is being used wisely: "It is of course important to know how one's money is being spent. I have met Gareth, and we were able to discuss his research. I was also able to see a prototype of his work. If I lived closer to Manchester there would most definitely be more contact".

The Scholarship really has been the difference for Gareth. He commented: "Without the Scholarship I wouldn't be financially able to do a PhD. With Keith's support I'm able to carry out the research that will perhaps one day lead to my own UAV consultancy company. I'd like to say thank you to Keith - without his support I wouldn't be here".

Keith employs a skilled workforce, and relies heavily on the availability of highly skilled and innovative engineers. He went on to say: "I need engineers for my company and they are not easy to find. Britain has lost a lot of manufacturing which could, if exported, have helped to pay for food and machinery imports. We should all do what we can to help and encourage young British engineers".

For information on how you can help support the University and its students, please contact Andrew Young, Senior Development Officer (EPS) on 0161 306 1683 or andrew.d.young@manchester.ac.uk.

HOW YOU CAN HELP

If 10 alumni give £7 per month, topped up by 25% extra funding from the government in Gift Aid*, we can provide an additional Opportunity Manchester Scholarship, worth £1,000 to a talented undergraduate student from Greater Manchester.

If 11 alumni give £11 per month, topped up by 25% extra funding from the government in Gift Aid*, we can cover the costs of an average Bridging Hardship Award, worth £1,717 to a student in unforeseen financial need.

**If you are a UK tax payer, we can claim back 25% in tax relief on the value of your gift at no cost to you.*

LEGACY GIVING

The University of Manchester is deeply grateful to those who choose to think of it in their Wills. Many alumni choose to support the University by way of a bequest or Will gift, because although support may not be possible at this moment, they can still make a benefaction to the University in the fullness of time.

A Will gift, no matter how small, can have an enormous impact in helping the University to maintain, and where possible enhance, high standards in teaching, research and scholarly enquiry for future generations.

140 years ago, Professor E R Langworthy of Manchester left £10,000 in his Will "to encourage discovery in physics" The current 'Langworthy Chair' holder is Professor Andre Geim, who is the fourth holder of the Langworthy Chair to have won a Nobel Prize, alongside Ernest Rutherford, William Bragg and Patrick Blackett.

If you would like to discuss supporting the University through a legacy bequest, in confidence, please contact Louise Wardle, Legacy Manager on 0161 275 7230 or louise.wardle@manchester.ac.uk.

Show your support for Manchester and donate online www.manchester.ac.uk/donate. To set up a monthly gift call 0161 275 2619 to speak to a member of the Your Manchester Fund Team.

To discuss more tailored support options for students, projects or research, contact Andrew Young, Senior Development Officer (EPS) on 0161 306 1683 or andrew.d.young@manchester.ac.uk.

ALUMNI ASSOCIATION A GLOBAL NETWORK



As part of our Alumni Association you are a member of a global network of more than a quarter of a million Manchester graduates. That is the largest alumni community for a campus-based university in the UK and it is a phenomenal network for you to access both face-to-face and online.

Our events run throughout the year across the UK and internationally and you can network with us online through our 8,000 strong University of Manchester Alumni Association group on LinkedIn. You can also follow us on Twitter @UoMAlumni and register for our exclusive alumni community, Your Manchester Online.

GET INFORMED

The 'Your Manchester Insights Lecture' Series is designed to showcase the University's outstanding research to our alumni and friends. Our alumni are invited to hear our experts speak on important and current topics and have the opportunity to get involved in discussions and meet other alumni with similar interests. This year's annual London Lecture, entitled 'The Global Energy Crisis: Addressing the Major Energy Challenges of the 21st Century', was attended by more than 100 alumni and guests. The event took the form of a panel discussion with four of the most informed experts on energy including Professor Colin Bailey, Dean of the Faculty of Engineering and Physical Sciences; Professor Andrew Sherry, Director of the Dalton Nuclear Institute; Professor Ian Cotton, Academic Coordinator for Manchester Energy; and John MacArthur, VP of CO₂ Policy at Shell. See page 19 for further details.

Manchester Energy is an interdisciplinary group which aims to conduct world-class research into energy technologies and their societal impact. You can read more about the work of the group on page 18.

More events to look forward to in the New Year include our flagship Cockcroft Rutherford lecture, which last year was delivered to 800 alumni by Nobel Laureate Professor Andre Geim, discoverer of the wonder substance graphene. You will find details and registration information for all our events on Your Manchester Online.

GET INVOLVED

Our Alumni Association is a thriving community of socially responsible, globally minded graduates with a promising eye on the future. You too can get involved with building a brighter future. Feel the reward of giving something back to the next generation of Manchester graduates and help us attract the best students by writing inspiring career stories which we will publish in our prospectuses and online. Come back to campus and give students an insight into your area of expertise and help guide their first steps into the professional world. Open doors and offer work placements to current students or internships to recent graduates. Enjoy the reward and value of becoming a mentor to a current student with all the flexibility you need; engage in a nine-month face-to-face programme or become an eMentor by email.

GET ONLINE

For all this information and more register for Your Manchester Online: www.yourmanchester.manchester.ac.uk or email the University Alumni Relations team: alumni@manchester.ac.uk.

MANCHESTER ENERGY TACKLING A GLOBAL CHALLENGE

Supplying sustainable, secure and affordable energy to an ever-growing population is a global challenge, and one that the University is keen to address.

As energy demand increases industry and governments are looking to academia to help develop diverse and green portfolios of energy resources, and to identify opportunities for substantive improvements in energy efficiency and conservation.

In response to the challenge, the University has created Manchester Energy, which brings together the research expertise of more than 200 academics from across a diverse range of disciplines. The breadth and depth of research being conducted at Manchester means that engineers, natural scientists, architects, economists, geographers can work closely with each other and with experts in social policy, business and governance.

It is the role of Manchester Energy to facilitate and maximise the value added from such collaborations, and to ensure close and appropriate links to private and public sector stakeholders.

The University's research portfolio covers a wide range of topics including energy sources, generation technologies, transportation of energy

and consumption. Capability in energy policy, systems modelling and economics integrates this expertise, and contributes to the debate shaping future energy policy and the development of technical solutions that meet the needs of this policy.

Manchester Energy is leading the way in shaping and exploring alternative energy strategies through specialised and interdisciplinary research, and is developing a 'systems thinking' and life cycle approach to tackling energy challenges.

This strategic approach and long-term vision is allowing Manchester to research alternative energy resources and supply networks, through to new energy demands and patterns of consumption. All of this is being considered not only in terms of the appropriate technologies, but also in relation to their associated social, financial and environmental impacts.

Manchester Energy is making a valuable contribution to a number of global challenge areas. Each challenge area is led by two members of academic staff and

sees contributions from staff and students across the University. The challenge areas include:

- Policy and system modelling
- Affordable energy
- Bioenergy
- Cities
- Future electricity networks
- Nuclear
- Offshore renewables
- Solar
- Sustainable hydrocarbon

The vibrancy of Manchester Energy is enhanced by the links the University has with partners, who benefit from the research that we carry out and the education that we provide to current students and existing employees. We work closely with industrial collaborators such as BP, Rolls Royce and National Grid whilst our technology transfer company, UMI3, manages energy related IP and develops spin-out companies that take our research from the laboratory into the field.

www.energy.manchester.ac.uk

Professor Ian Cotton, Academic Coordinator for Manchester Energy



YOUR MANCHESTER: THE GLOBAL ENERGY CRISIS

Some of Manchester Energy's world-renowned academics recently hosted a Your Manchester lecture to discuss and respond to the global challenge of energy supply. The event, held in London, was chaired by Professor Colin Bailey, Vice-President and Dean of the Faculty of Engineering and Physical Sciences, with Professor Andrew Sherry, Director of the Dalton Nuclear Institute, and Professor Ian Cotton, Academic Co-ordinator of Manchester Energy and John MacArthur, VP of CO₂ Policy at Shell.

This year's annual London lecture, titled 'The Global Energy Crisis: Addressing the Major Energy Challenges of the 21st Century', was attended by over 100 alumni and guests. The lively public debate during the event included a question and answer session which included topics ranging from current nuclear research at the University, electrical energy and the smart grid, increasing global population and the impact on energy supply, shale gas and how important this will be as an energy source, likely future skills gaps in the energy and environmental technology industries, and much more. The audience presented a broad range of technical and thought provoking questions relating to the future of the global energy mix which challenged our panel of experts.

Professor Ian Cotton said: "Manchester Energy encompasses research from over 300 academics across the University and it is vital that we engage with all sectors including our alumni to maximise the impact of this research. I hope the participants will learn more about the strength of energy research at Manchester and will help us develop opportunities in the future".

TEAMING UP WITH MOSI ON ENERGY

The University is working with MOSI (Museum of Science and Industry) to bring its energy research and innovative technologies to a younger audience. MOSI is planning its next major development project, working with the theme of Energy and Innovation.

A key challenge is to fire its visitors' imagination about energy, and to empower them to make wise energy choices through fresh resources, exciting interactive displays, and a brand new look at the energy story.

The University has provided several energy related display items, including a composite cross-arm, a new technology which allows the up-rating of existing electricity power lines to increase tower voltage without structural change to the towers. The University has also provided new content for MOSI's Revolution Manchester Gallery including the novel wave generator 'the bobber' which is being developed at Manchester Highlight. The University will work on developing experiments for the Museum's new energy theatre which will form part of the Energy Galleries plan.

Ian Cotton, Professor of High Voltage Technology and developer of the cross-arm composite, commented: "This collaboration gives us the chance to showcase the fantastic work we do within science and engineering, and to engage with school children and the general public to show them how our research is informing everyday life".

John Beckerson, Senior Curator at MOSI, said: "Working with the University gives visitors the opportunity to witness real innovation in action, and to see the wealth of incredible ideas which still come from this great industrial and scientific city".

www.mosi.org.uk



MOSI's new Revolution Manchester gallery (Chris Foster/MOSI)

CLIMATE CHANGE CENTRE IN SHANGHAI

The Tyndall Centre for Climate Change is a partnership of eight UK universities including Manchester, which brings together scientists, engineers, social scientists and economists to develop sustainable responses to climate change. This summer the Centre celebrated its launch in Shanghai. Deputy Director, Professor Kevin Anderson travelled to the event in an appropriate style. His blog, right, reveals how he got on.

Tyndall was founded in 2000 and has developed an outstanding reputation for its research and for providing independent and often challenging evidence to UK and EU international policy makers and wider business stakeholders.

The Centre expanded its reach in July when its Chinese hub was opened at Fudan University in Shanghai - one of the 'big three' universities in China. Fudan Tyndall is funded by a 15-year commitment by the Chinese central government and the Shanghai City government. The

Shanghai partner brings new expertise to Tyndall in human demography, air pollution and human health, urban design, ecology and biodiversity. Professor Kevin Anderson is Deputy Director of the Tyndall Centre and explains the importance of the new partnership. "The inclusion of Fudan University offers an invaluable opportunity to pool Chinese and UK university expertise to tackle both the pressing challenges of reducing greenhouse gas emissions and advancing climate-resilient development."

David Cameron highlighted the value of the Fudan-Tyndall relationship when he led a UK delegation to China last November. China is well on the way to becoming the most powerful economy in the world. The country's growth will dramatically influence global climate change and the world's food, energy and human security.

The Fudan Tyndall Centre's research priorities will focus on moving to a low carbon economy; adapting people and places to the impacts of climate change and securing supplies of food and water. New collaborations between UK and Chinese researchers will provide key insights on the drivers of global change and help manage the way the world is developing.

THE SYMPOSIUM AND LAUNCH...

A major symposium was held to celebrate the launch of the Fudan Tyndall Centre, which addressed a wealth of issues centred around climate change with high-level speakers from both China and the UK. This was not only an excellent opportunity for researchers from the different communities to get to know each other, but also identified concerns common to both nations, stimulated discussion about alternative approaches for addressing these and brought to the fore different interpretations of what climate change meant for nations as distinct as China and the UK. Leading into the annual Shanghai Forum, with its 'Grand Challenge' focus on energy and climate change, the Tyndall Fudan launch was the prelude to an intense and highly productive week of engagement between Chinese and UK academics, policy-makers and business leaders.

INTERDISCIPLINARY RESEARCH AT THE FUDAN TYNDALL CENTRE INCLUDES:

Societal Role of High Emissions Groups

Comparing the emissions profiles of different high-emitting groups within China and Europe and developing low-carbon technologies and policies tailored specifically to those groups.

Elemental Nitrogen Cycling

Identifying opportunities for mitigating greenhouse gases from agriculture. Analysing plant-microbe interactions and soil properties to better understand how N2O emissions could be reduced and carbon removed and to help guide policy and practice.

Water Security

Improving the understanding of water scarcity, extreme events and the water-energy nexus.

Aerosols

Understanding the chemistry of aerosols related to air pollution in particular but also their role in climate change. Links already exist in this important area between Fudan and the School of Earth, Atmospheric and Environmental Sciences at Manchester.

GETTING THERE

You're deputy director of a climate change research centre. You need to be at the launch of your centre's expansion to China at the Fudan Tyndall Centre. Stepping off a jumbo jet wouldn't look good, so Professor Kevin Anderson tested his theories on 'productive' low-carbon travel with a ten-night working trip from Broadbottom to Shanghai... and back!

Broadbottom – Warsaw

Broadbottom – Shanghai met its first obstacle in Broadbottom – no train! So the journey's carbon graph started with a blip – a taxi to Stockport to catch the 7.04 to London.

I arrived in time to soak up the French ambience of St Pancras before the Eurostar whisked me off to Gare du Nord and the real thing. A brief plat du jour in a restaurant on a nearby side street and I was alighting the next leg of the journey to Cologne where I catch the night train to Warsaw.

I was sandwiched between two ample Polish lads on the sleeper, service engineers with an Indian company manufacturing machinery for the pharmaceutical industry. Returning from Germany where their machines had been installed, they were off to India the following week to update their training. Wherever you turn there's a carbon lesson to be had.

Warsaw – Kiev – Moscow

After a morning discovering the delights of a wet Warsaw I set off on the leg to Kiev. I managed several hours' work before noting my roommate was marking a dissertation in Polish but with a title that included the consecutive words Klimatzy Chnze – or something very similar. "Of all the carriages of all the trains in all the world a climate scientist walks into mine" – though he didn't look much like Lauren Bacall – and I doubt anyone would mistake me for Bogart!

I had fifteen hours in Moscow until the Trans-Siberian began its long saunter East. I stumbled upon the Lenin Bibliotheca and had a peaceful and productive few hours – helped by the absence of wireless, emails and admin. A protracted and scary encounter with a security guard over my vital Trans-Siberian handbook left me with only minutes to catch the next train to Beijing.

Moscow – Beijing

So this is it – the Trans-Siberian – a collection of hippies seeking utopia in the East, wealthy old-timers on a jaunt to inhale the spices of the Orient, and Agatha Christie junkies waiting for the first blood-curdling scream. Not sure where the mad Prof on a works trip to save a gram or two of carbon fits in, but I was very happy soaking up the history of travellers wrapped up in the worn wood panelling of our old Chinese train.

After the seven-stage pogo so far, a single leap from Moscow to Beijing is a welcome relief – no more hauling my personal affects around. I can settle down to reading a few papers and writing one on shipping emissions. Every so often I'd look up to see trees or large empty plains where trees should have been go past, giving way as we headed much further East, first to the tranquil beauty of Lake Baikal then the vast expanse of Mongolia's steppelands and the Goby desert. Finally, and in stark contrast, the fairytale rock towers and green valleys of China loomed as we threaded our way through tunnels, over bridges and along precipitous ridges towards Beijing.

Beijing - Shanghai

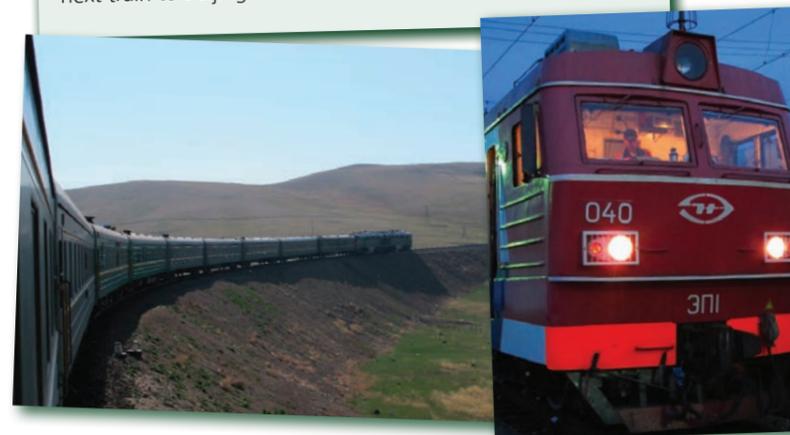
I'm living the dream of the UK's early railway pioneers on the Beijing-Shanghai leg of my journey. I've turned the multichannel TV off at the foot of the bed, switched on my LED reading light, placed my phone on the table next to my bed, adjacent to the vase of flowers (honestly) and tucked my luggage in the copious space provided. I share the spacious cabin with my three roomies – all of whom are now sound asleep, probably not too worried by the £60 fare for a 1400km journey.

SLOW AND LOW – THE WAY TO GO

Travelling slowly changes our perceptions of essential travel. It forces us to travel less and to be more selective in what we attend and to endeavour to get more out of those trips we do take. Fewer trips and potentially longer stays – not rocket science, just climate change basics.

From a productivity perspective, the 20-day train journey easily trumped the two-day flight. A carefully planned train journey not only delivers order of magnitude lower emissions, but it also facilitates the process of research in a way that universities and daily life simply can't match. Add to that the 'slower' ethos that such journeys engender and I think there may be early signs of making a meaningful transition to a low-carbon future – or at least a bridging ethos whilst we wait for the panacea of low-carbon technologies to become the norm.

Professor Kevin Anderson holds a Chair in Energy and Climate Change at the School of Mechanical, Aerospace and Civil Engineering. He is also the Deputy Director of the Tyndall Centre for Climate Change Research.



WHERE ARE THEY NOW?



When our class of 2006 left the University just five years ago they faced a very different landscape to today's graduates.

This month unemployment has hit a seventeen-year high with almost a million under 25 year olds without a job, and the economy showing no signs of coming out of the worst international recession for 80 years. Meanwhile, back in 2006 the economy had been growing for twelve years, inflation was low and employment figures were high. A stable, positive atmosphere to graduate into.

We caught up with some EPS graduates to see how the economic rollercoaster has treated them.

CHRIS CLACK

Dr Christopher Clack came from Caythorpe in Lincolnshire to study Mathematics and Statistics, attracted by the reputation of the course. He now lives in Colorado in the USA.

I went straight on to do a PhD in Applied Mathematics at The University of Sheffield.

After completing my PhD, I moved to the USA to take a postdoctoral position at a private company. From there I was awarded a postdoctoral fellowship with the National Academy of Science to work at NOAA. This is where I am currently!

Luckily, unlike some of my peers, I managed to get positions in research with the budget cuts. I moved to the USA due to the budgetary cuts in my field and the lack of jobs available for me to apply for. The recession actually taught me new and interesting techniques for finding jobs with companies and agencies that are not advertised as well.

Over the next five years I hope to further my research career and, hopefully, get tenure at a university as a lecturer.

I have contact with some of the lecturers I had as an undergraduate, now as colleagues in mathematics. I am also still in contact with a number of my fellow flatmates, course friend and other students from the University.

I think my best memory of the University are the nights out with all my new friends during fresher's week. Such a change in lifestyle from school. The worst times were definitely the revision sessions for the final exams - long, long nights!

University is the place where I learned how to be an adult and acquired all the skills I have needed for my professional and personal life now!

CRAIG J HARGROVE

Craig J Hargrove lived in Sandbach in Cheshire when he came to Manchester to study Computer Science with Business and Management. After graduating he went travelling in South Africa and Australia, returning to start a job in May 2007. He now lives in New Mills, on the edge of the Peak District and is a software engineer.

I joined Digital Applications International as a software engineer when I got back from travelling. I'm leading the development of the SCADA system for Heathrow airport at the moment. I have worked on other projects, including a huge Tesco warehouse in Middlesborough. Overall the general principle of what I've been doing is similar, developing and testing software, but I've been given increasing responsibility as the years have gone by.

Fortunately I found work before the recession hit, and my company have handled the recession well, remaining profitable throughout, however it has made it harder to consider moving on to other work. I don't want to risk making a change I can't easily undo.

I have fond memories of University and I'm still in contact with many fellow students. My favourite time was the third year, realising that I could manage the pressures of the work while still having a good social life. The lowest moment was probably an exam where it seemed I knew nothing on every question asked. I still shudder at the memory!

BENJAMIN DAVID

The reputation of the University and the School of Chemistry lured Benjamin David north from London to study Chemistry.

When I graduated I got a job in the London area with GlaxoSmithKline. I worked there for just over a year. I still love chemistry but I found the reality of the industry very different to studying the subject.

I then got a job in the City with a small information provider to investment banks and law firms. My goal after working in the City was to try to get a front office position at a bank or broker. As a result I have subsequently traded FX and most recently I am a soft commodities broker.

The last five years have been emotional!! I have been made redundant 3 times since leaving Manchester, all because of the economic climate. I have now got into a much more stable position with good future prospects. It really does go to show what can be achieved with hard work and perseverance, even in these times.

I did have to work in an area of the financial industry that I was not expecting to, and I think that was a direct result of financial intuitions closing their doors to anyone who did not have prior experience when the recession started biting.

As a result it has taken me a lot longer to finally get into a position that I am happy with and would like to make a career of.

If you tracked me down in five years I would like to be well on my way to being a successful soft commodities broker/trader. I'd also like to be married to my girlfriend (who also went to Manchester) and starting a family.

That's the plan but from my experience life doesn't always go according to plan. Contact me again in five years and let's see!

GEORGE ANDREAKOS

George Andreakos came to UMIST from Athens to study Electrical Engineering and Electronics. Five years on he's still in Manchester working for Electricity North West.

I chose The University of Manchester (UMIST when I joined) because it's one of the most reputable universities in the country. The Department of Electrical Engineering is amongst the top in the world. I also liked the city's history and culture in lifestyle, music and sports when I visited for first time at an Open Day.

After graduation I received a full scholarship from MMU to study for a Masters Degree in Computer and Network Technology. I then joined one of the biggest construction companies in the UK, Bovis Lend Lease, as a graduate design engineer. I stayed there for a couple of years. I've recently got a great new job with Electricity North West (ex United Utilities). I also work voluntarily as Publicity Officer for the IET Manchester Network Executive Committee.

Despite the fact that I was made redundant from Bovis at the end of last year, I feel that I was lucky. I received a masters degree in the last five years and I got a job with a great company after graduating. It was very frustrating when I was made redundant but I've managed to make a great career step since I joined Electricity North West two months ago.

Manchester is now my second home. It is a very friendly city, even though it's busy. I lived here as a student and now as a professional and I still find it very interesting and diverse.

The University is a passport to a great future. I have been to a few interviews and I've noticed that it is well recognised and respected by employers. I am proud of my achievements and I believe that it was the best choice I could have made.

2006 WAS THE YEAR...

ITALY WON THE WORLD CUP IN GERMANY

SVEN GORAN ERIKSSON QUIT AS MANAGER OF THE ENGLAND NATIONAL FOOTBALL TEAM

ROGER FEDERER WON WIMBLEDON

STEVE IRWIN WAS KILLED BY A STINGRAY

IT WAS 250 YEARS SINCE THE BIRTH OF MOZART

SLOBODAN MILOSOVIC WAS FOUND DEAD

ELIZABETH II TURNED 80

ALEXANDER LITVINENKO DIED IN LONDON OF POLONIUM POISONING

SADDAM HUSSEIN'S DEATH SENTENCE WAS CARRIED OUT

SIR MENZIES CAMPBELL WAS ELECTED LEADER OF THE LIBERAL DEMOCRATS

RICHARD DAWKINS' BOOK THE GOD DELUSION WAS PUBLISHED

THE MUHAMMAD CARTOONS WERE PUBLISHED IN DENMARK

A SQUIREL DISRUPTED THE CHAMPIONS' LEAGUE FOOTBALL MATCH BETWEEN ARSENAL AND VILLAREAL

THE ARCTIC MONKEYS MADE HISTORY WITH THEIR FASTEST-EVER SELLING DEBUT ALBUM IN THE UK

RACE HORSE DESERT ORCHID DIED

BRINGING CHEMISTRY ALIVE

The Faculty of Engineering and Physical Sciences runs many successful outreach programmes, designed to promote opportunities for progression into higher education, and to identify and attract talented prospective students from all educational backgrounds. In this issue we focus on the School of Chemistry's lively and innovative projects for young people.

The University is a major provider of STEM subjects (science, technology, engineering and maths) at degree level. The availability of activities to support the take-up of STEM subjects in school, and university, is having a positive impact on the number of pupils opting to continue with science subjects beyond school.

One major success is the work carried out within the School of Chemistry, which has a fantastic record of providing high-quality, flexible and professional services to schools and colleges. It is recognised as a beacon of outreach activities within the University. Its breadth of research allows it to demonstrate, with both hands-on and spectacular science, a huge range of chemistry subjects. This gives pupils an idea of the range of opportunities and pathways available to them when considering chemistry at university, and entuses younger students to take an interest in science so that such opportunities remain open to them.

Last year it interacted with more than 25,000 primary and secondary school pupils and members of the public, who took part in a range of activities, from ten minute presentations and hands-on

experiments through to six-week research projects.

Outreach work includes **Flash-Bang** science demonstrations for pupils aged 5-18, which gives pupils the chance to get up close and personal with visual and aural demonstrations. These fast-paced lectures are designed to raise interest in and excitement about chemistry, and include colour changes, fireworks, chemiluminescence, flame colours and explosions. A previous attendee from Winsford Academy said: "It was brilliant, I thought when they did all those bangs and things on TV it was just special effects and made up on a computer not science... he was like a magician, I want to do that when I am older". Gayle Ruddick (UMIST Chemistry 1998, currently Assistant Director of Science, Winsford Academy) commented, "They are all now interested in what you actually do at university and asking questions regarding careers in science and also how they can get your job; they now actually recognise that I am a scientist and not 'just' a teacher (they never actually linked the two together)".

There's also a **Solids, Liquids and Gases Show** which works alongside the

primary science syllabus in a memorably spectacular way. As well as seeing the show, pupils can develop scientific observation, recording and deduction skills, in a hands-on bath bomb workshop. One Year 5 pupil from Chinley Primary School, Owen Bradley, said: "I really enjoyed doing the explosions, and the bath bombs were the best!"

Secondary school pupils can take part in a range of chemistry activities including **Polymer Day** for Year 9 students, where pupils learn about macromolecules, perform ring-opening and condensation polymerisations, and polymer crosslinking

The School's **Synthesis & Spectroscopy** tours allow more senior secondary students to get a taste of what it's like to work in a laboratory making molecules, and using spectroscopy to find out what they've made, which compliments their A-level syllabus.

Spectroscopy in a Suitcase is an RSC initiative, which sees the University taking a state-of-the-art ATR-IR spectrometer out to schools. Year 12 pupils are able to make paracetamol, and prove they have done so by comparing their own IR spectra of starting material and product. Younger pupils take part in a suite of polymer-based activities, including identification of various different plastics, using the IR spectrometer. The School's **Photovoltaic Cells Activity** teaches pupils about one

of the ways chemical research is trying to solve the energy question. They can make their own cells to generate electric current from sunlight.

The School's **Nuffield Research Bursaries** allow promising Year 12 and 13 pupils to sample real research, for up to six weeks, before they make their final degree choice.

Salters' Chemistry Festivals give year 7/8 pupils the opportunity to spend a day in a university department and to take part in practical and fun chemistry activities. The objective is to promote an appreciation of chemistry. More in-depth experiments are possible during the longer residential **Salters' Chemistry Camps** which hosts Year 10/11 transition pupils.

Frank Mair, who combines his main duties as a lecturer in inorganic chemistry with his role as Director of Outreach for the School of Chemistry, commented: "We work hard to spark interest in our subject, and it's a real joint effort.

"This year in particular has seen a spike of interest and offerings due to many factors including International Year of Chemistry 2011, and better collaboration with the RSC. We now host Katayune Presland, RSC Regional Co-ordinator for the North West, and Kristy Turner, RSC-Teacher-Fellow, on secondment from her position as Head of Chemistry at Westhoughton High School, Bolton."

During 2012 the School will continue to promote and support International Year of Chemistry, as well as work with the Royal Society of Chemistry, and is currently working to target even more local schools in line with the University's widening participation agenda.

The School also reaches out to the general public with its festival-style activities. Events such as Faculty's **Science and Engineering Week**, **Manchester Science Festival Science Spectacular**, **Meet the Chemists Days** at the Museum of Science and Industry, or this year's inaugural **Jodrell Bank Summer Science Fair**, attract an audience of interested adults and their enthusiastic children. This gives us the opportunity to entertain the young budding scientists while we engage the more mature with research. We have a suite of fun, short-term hands-on activities, and are supported in this by the RadioChemistry DTC and photochemistry research groups.

The School also facilitates the teaching of chemistry by hosting '**Meet the Examiner' sessions** for teachers of AQA chemistry A-level. Further details on any of these activities are available by emailing outreach@chemistry.manchester.ac.uk

www.eps.manchester.ac.uk/science-for-all



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