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UNIVERSITY OF Southampton
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New Boundaries | Issue 15 | November 2012

Performance sports excellence

Our expertise helps British athletes achieve success

Towards personalised medicine
Pioneering genetics research could lead to tailored treatments

World Wide Web success
Linking every person on the planet

Discovering diamonds
Insights into the dynamics of volcanic eruptions

In this issue

Welcome to *New Boundaries*, the University of Southampton's research magazine. In this issue, we aim to give you a small insight into the variety of the cutting-edge research that is taking place at the University and how it is changing the world, in this our 60th year.

On page four, you can learn how Southampton researchers from Engineering and the Environment, bring together science and sport to help optimise the performance of British athletes by analysing their technique.

While our engineers are analysing sporting data, our researchers from Medicine are analysing genetic data from individuals suffering from inflammatory bowel disease, with the overall aim of providing patients with personalised treatment plans. Read more on page 10.

Our genetic data links everybody on the planet, but the World Wide Web also connects every person via their computer. Our researchers at Southampton are continuing to help develop the Web so that data is more available when needed; find out more on page 16. And without the World Wide Web, our researchers in Psychology wouldn't be able to help millions of people by providing them with web-based advice for managing health conditions – read more on page 20.

In this, our 60th year as a university, we are celebrating our staff, students and graduates. On page 22, discover how our Special Collections archives have preserved the unpublished works and correspondence of one of our first English professors, F T Prince, who is increasingly recognised as one of the most significant 20th century British poets.

And from the discovery of a precious collection of literature to a volcanic process involving diamonds, the most precious stone on the Earth. Geologists from Southampton have discovered a previously unknown volcanic process that links the manufacture of confectionary with the mining of diamonds and explosive volcanic eruptions. Delve deeper into this research on page 26.

This year to celebrate our 60th anniversary, we are promoting 60 of the University's world-changing successes and achievements. For more information, visit **www.southampton.ac.uk/60**

For more research stories, visit **www.southampton.ac.uk/research**

Please send us your feedback
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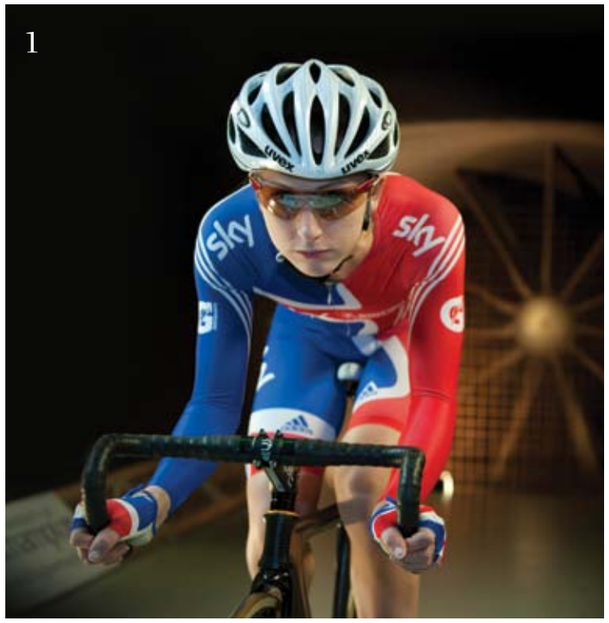
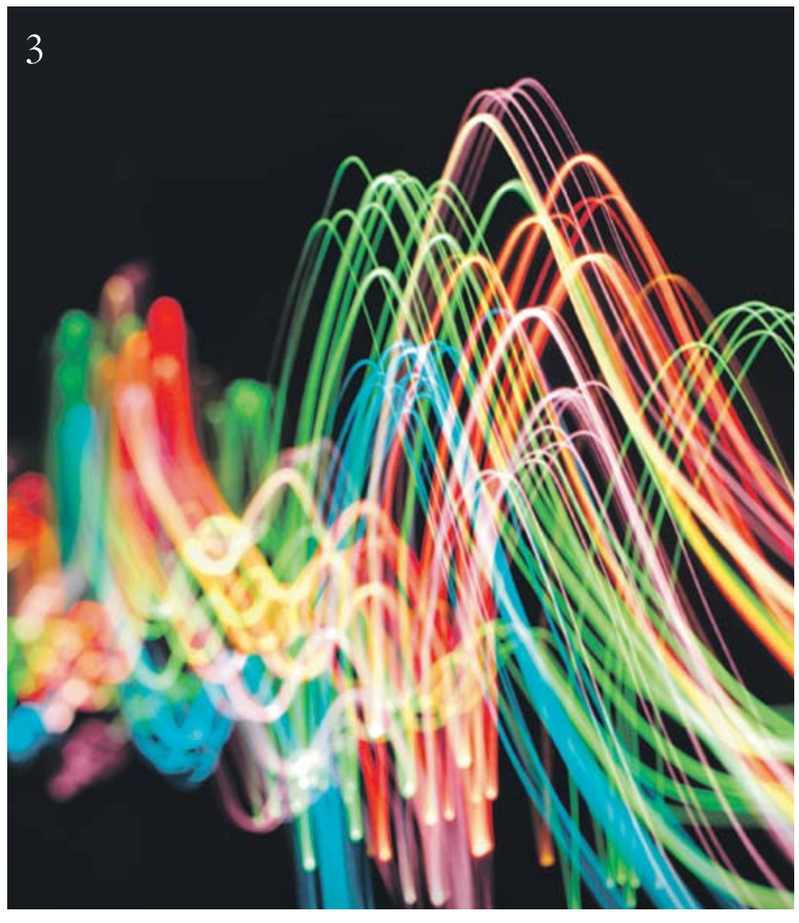




More highlights

Performance sports excellence

When the difference between winning and losing is down to hundredths of a second, anything that gives you the edge is an advantage. At the University of Southampton, our engineers are bringing together science and sport to optimise the performance of British athletes.

"Gold medals can be won or lost within fractions of seconds and our job is to ensure the athletes are in the best possible position to take advantage of those tiny margins. The knowledge and expertise that the University of Southampton contributes is critical to our work."

Dr Scott Drawer,
Head of Research and Innovation at UK Sport

In partnership with UK Sport, our engineers are helping British athletes to improve their performance

The University has been engaged in performance sports engineering for over 40 years, achieving an unrivalled international reputation for innovative engineering design and aerodynamics for performance sports. From high-performance engineering in Formula 1 (F1) cars and America's Cup yachts, through to technical support for elite athletes in cycling, kayaking, rowing, downhill racing and now swimming, the Performance Sports Engineering Laboratory (PSEL) at the University has made a unique and exceptional contribution to the success of sport in the UK.

Innovation and expertise

The PSEL groups together academics and research engineers from Aerodynamics, Computational Engineering and Ship Science. The internationally renowned Wolfson Unit for Marine Technology and Industrial Aerodynamics (WUMTIA), has worked closely with the yachting industry, developing longstanding associations with numerous America's Cup teams and contributing significant improvements to the design and safety of racing yachts.

Our advanced rolling road wind tunnel technology developed here provided facilities and expertise for several UK F1 teams and the almost unbeatable Penske Indy Car teams in the 1980s and 1990s.

The University's contribution has been recently recognised when it received the prestigious Queen's Anniversary Prize for higher and further education in February 2012, for innovation and world-leading expertise in performance sports engineering.

"I am delighted the long-standing achievements of the University have been recognised in this way. We have seen our research impact at the highest level in competitive sport, but are equally proud of our graduates who excel in the ultra-competitive technology driven world of motorsport and performance sailing," says Professor Stephen Turnock, Director of the PSEL. "It is rare to find a team without one of our ship science, aeronautical or mechanical engineering graduates playing a leading role."

Supporting UK athletes

Stephen explains that the University's international reputation resulted in UK Sport approaching the team in 2005 to access its resources. Since then our engineers have had a close working relationship with UK Sport and in 2007 the WUMTIA was awarded the prestigious status of Innovation Partner, a relationship that continues today. This partnership has been focused on sports involving high speed where there are potential gains in the aerodynamic and hydrodynamic characteristics of the athletes and their equipment. Complementing this has been the support by UK Sport of a steady stream of PhD students looking at longer term research and development.

By using the wind tunnels, engineers from the WUMTIA have used their expertise to help the British Cycling team to focus on improving the understanding of the complex aerodynamic interactions involved. Stephen explains that the research is all about the athlete's positioning on the bike. "It is about finding what is best for each athlete and how this can reduce drag." The team measures the small changes in drag and searches for the optimum body position. "We assess the fluid dynamic flow to understand how subtle changes in body position can better control the flow," Stephen explains.

Winning combination

The results for the British Cycling team have been dramatic. From coming third in the medals table at the Athens Olympic cycling events in 2004, Great Britain progressed over the next five years to come top of the medals tally for three out of six UCI Track Cycling World Championships and in 2008 to lead the Beijing Olympic cycling medals table by an impressive margin. British Cycling has greatly improved its world standing in track cycling and is now considered the dominant force in the sport.

At London 2012 Olympic Games, the British Cycling team were even more successful. In track events, they won gold in the Men's Sprint, Men's Team Sprint, Men's Team Pursuit, Men's Keirin, Women's Keirin, Women's Team Pursuit and Women's Omnium. They also won silver in the Women's Sprint and bronze in the Men's Omnium. In road events, the team won gold in the Men's Individual Time Trial and silver in the Women's Road Race.

Along with research in collaboration with British Cycling, other research has focused on the winter sport of Skeleton. Amy Williams was helped to her Skeleton Gold Medal in Vancouver 2010 by the University. Her sled was designed by two of our graduate students and over 200 hours of wind tunnel testing helped Amy find her optimum sliding position. The four-year project combined experimental work, the latest computational analysis techniques, and testing in wind tunnels, to improve the understanding of skeleton performance. Competition within this sport is fierce and the margin of victory can be as little as 0.01 of a second. ▸

"It is about finding what is best for each athlete and how this can reduce drag."

Professor Stephen Turnock, Director of the Performance Sports Engineering Laboratory

Our researchers provide British swimmers with data to help them improve their technique

Head of Research and Innovation at UK Sport, Dr Scott Drawer, explains: "Gold medals can be won or lost within fractions of seconds and our job is to ensure the athletes are in the best possible position to take advantage of those tiny margins. The knowledge and expertise that the University of Southampton contributes is critical to our work."

Improving technique

More recent research at the PSEL, in partnership with UK Sport, involves helping British swimmers to improve their performance. Using a controlled overspeed tow winch, four or five wireless sensors on the swimmers' body and a camera attached to a device that follows the swimmer along from the side of the pool, the team can measure the forces and drag acting on the swimmer.

The team uses commercial sensors, similar to the ones that are in smart phones, to capture the large amounts of data needed to analyse the forces and drag that the athletes' bodies have. "You can also use optical motion capture devices with point light sources on different parts of the body to see what the trajectory of the body is in time and space," says Stephen.

"We can put up on the screen straight after they have finished their swim, information on the details of their stroke and the efficiency with which they are propelling themselves. And this provides them with data that many of them have never seen before, but that they can use with their coaches to try and work on improving their technique," says Dr Dominic Hudson from the Fluid Structure Interactions group.

"The winning margins are so much smaller than they used to be; we need to find new areas to make advances. These days, improvement comes through the accumulated effect of many smaller gains, rather than through achievement of one large step change. And research like this allows us to pinpoint these small gains and identify areas where improvements can still be made," explains Angus Webb a PhD student involved in the project.

At London 2012 Olympic Games, the British Swimming team won silver in the Men's 200m Breaststroke and bronze in the Women's 800m Freestyle and the Women's 400m Freestyle.

Influencing efficiency

UK Sport and our British athletes are interested in knocking fractions of a second off times in order to be successful. But the same challenges are tackled in Ship Science at the University, where all the small details that can make a difference on the energy efficiency of ships are investigated, explains Stephen.

"Currently, three or four per cent of the world's carbon dioxide emissions come from shipping. Over the next 30 years that could go up to 20 per cent, so the challenge is to reduce this," he says. "The big wins have already been found, so it is all about small details again and actually the performance sport work is a precursor to what has to be done in the shipping world."

Similar sensors to the ones that measure the forces and drag of British swimmers in the water are being used to analyse how ships respond to large rogue waves. "We put a string of sensors down the hull of a ship model in order to understand how the ship flexes under the wave loads," says Stephen. "It is much simpler than previous ways of measuring these forces and it appears to be as accurate, if not better than previous methods."

For more information on performance sports engineering at the University, visit **www.southampton.ac.uk/performancesports**

Key facts

- The University of Southampton has been involved in performance sports engineering for over 40 years.
- The difference between winning a gold or bronze medal in cycling or swimming can be as little as hundredths of a second.
- At London 2012 the British Cycling team won 11 medals, eight of which were gold, thanks in part to engineering at Southampton.

Towards personalised medicine

Researchers at the University of Southampton are investigating the genes that are responsible for Inflammatory Bowel Disease (IBD) in children, with the aim of personalising treatments for individual patients.

Complex diseases such as IBD, asthma, heart disease and Alzheimer's disease are not caused by a mutation of just one gene, but by mutations of multiple genes in our genetic code. In order to help patients with IBD, a team of researchers in the Genomic Informatics Group at the University, are looking at the genetic code of individual children that suffer from IBD to build up a profile of which genes cause the disease.

Debilitating disease

IBD is a group of inflammatory conditions of the colon and small intestine. The major types of IBD are Crohn's disease, which affects any part of the gastrointestinal tract from the mouth to the anus, and ulcerative colitis, a condition that affects the lining of the colon. However, there are many different sub-categories of these two types of the disease, making it difficult to treat individual patients effectively.

In addition, there are a significant number of patients under 18 years of age that are diagnosed with IBD and even toddlers can suffer from the disease. "It is a hugely debilitating disease and is almost an order of magnitude more severe in tiny children, because they are at an age when they need to take on nutrition in order to grow," says Dr Sarah Ennis, Head of the Genomic Informatics Group. "As the disease begins in childhood, we suspect that environment has less of a role to play than genetics, so this is a good hunting ground for us to look for genes specific to IBD," she adds.

Sarah explains that human genomics is the study of the complete genome and involves determining the entire DNA sequence and mapping genetic code. A genome encodes all of an organism's hereditary information and can hold the key to the diseases that any individual could be susceptible to.

"In 2003 it took about $10bn, multiple groups around the world and 10 years of research to get one reference human genome," says Sarah She explains how far we have now come: "Now I can spend between £400 and £700 to get the genetic sequence for all of a patients' exomes – the regions of the genome that code for proteins and are most likely to contain mutations with disease impact." ▸

Human genomics is the study of the complete genome and involves mapping genetic code

Genetic information from the parents of a patient and other family members that suffer from IBD, is collected in order to find out which genes cause the disease

"At some stage in the future, it will be possible to take a patient's blood sample and with that predict the genetic pathways that are sub-optimal or functioning very poorly, the types of bacteria in the gut and personalise the treatment to keep the disease at bay."

Dr Sarah Ennis,
Head of the Genomic Informatics Group

DNA sequencing

Housed in University Hospital Southampton is the regional referral centre for children diagnosed with IBD. Sarah's team started working with clinical colleagues in October 2010 to recruit eight children to their study looking at the genetics of paediatric IBD, but now they have about 160 patients. The team are using Next Generation Sequencing (NGS) technology to create individual profiles of genetic changes across a panel of genes known to influence IBD risk.

Blood is taken from the patient and the DNA is extracted. The team then send the DNA for sequencing which involves the use of molecular techniques to target the sections that code for proteins. The extracted sections are then broken up into smaller parts that contain only about 150 base pairs of DNA. "These are put through the sequencer, and multiple reads of these sections identify the exome of a gene," says Sarah.

"For each patient we have produced a profile of their individual variation across the genes that are known to influence IBD risk. We have found that despite having common diagnoses, each individual presents with a unique profile of genetic variants," says Sarah.

The complete picture

The University hosts the only National Institute for Health Research (NIHR) funded biomedical research centre for nutrition in the country, which means that as well as characterising the patients' clinical progression and obtaining their DNA for analysis, Sarah and her team can characterise the nutritional status of each patient as well as assessing how each patient responds to certain drugs. "We also get the parents' DNA and the DNA of any other family members that may suffer from the disease," she says.

The team is also working with the University of Aberdeen to look at the microbiome data – the bacteria in each child's gut – to see if there are any similarities between patients. The team will therefore have all the data on each patient's expressed genes, all their surgical, clinical and nutritional information as well as information on the bacteria present in their guts. "We plan to get this data at the time of diagnosis, time of remission, and time of relapse. So we are trying build up the complete picture and history for each individual," says Sarah.

Personalised medicine

The amount of data that the team is collecting on each patient can use up gigabytes of memory. To help analyse the information, the team is using *Iridis 3*, Southampton's supercomputer, in order to produce one computer file for each individual containing all the variants that are different from the reference human genome.

"We can then use these data to look at which genes in the particular patient cause the disease," Sarah tells *New Boundaries*. "By identifying the specific sub-sets of genes that cause the disease on a case-by-case basis we may be able to target drugs to the individual thereby personalising their clinical treatment."

As new drugs and therapies emerge, knowing which specific biological pathways are impaired on a case-by-case basis will lead to targeted treatments tailored to individual patients. The team plan to build on this work to identify which specific and detailed clinical characteristics are shared by patients with similar genomic profiles. "Ultimately, this may help us give much more specific diagnoses to individuals rather than the 'umbrella terms' that are currently used and this in turn will help inform clinicians of the best treatments for their patients," says Sarah.

Future plans

"At some stage in the future, it will be possible to take a patient's blood sample and with that predict the genetic pathways that are sub-optimal or functioning very poorly, the types of bacteria in the gut and personalise the treatment to keep the disease at bay," says Sarah.

The team expect that their findings will translate into adult medicine as well as aiding screening in relatives of those affected by this familial disease. "We are not trying to just find one more gene that might be involved in IBD, we are looking at individual patients, building up profiles of all the sub-optimal genes in order to understand the variety of genes involved."

For more information, visit **www.southampton.ac.uk/medicine/sarahennis**

Key facts

- Approximately 180,000 people in the UK are affected by IBD.
- The peak age of onset for IBD is 15 to 30 years old, although it may occur at any age.
- About 10 per cent of IBD cases occur in individuals younger than 18 years.
- Researchers at Southampton are working towards personalised treatments for IBD patients.

Personalised online experience

Small- and medium-sized enterprises (SMEs) are vital to the UK's economy, but in periods of economic hardship many fail. Dr Paul Harrigan, who joined the University of Southampton in 2008 as a lecturer in marketing, investigates how social media and web-based analytical software can be used to help SMEs by improving customer relationships and online experience.

Q *What are the main aims of your research?*

My research looks at how new social media technologies can be used for customer relationship management (CRM). CRM basically involves engaging with customers in an interactive manner. It also involves gathering, managing and analysing large amounts of data on online consumer behaviour using web-based analytics software such as Google Analytics in order to enable businesses to improve their service.

A lot of my work is about personalising websites for customers so that they can find a product quicker. Businesses can also adapt their website when the customer is viewing it from a smart phone or based on the information they put into the search engine.

Q *How does your research help businesses?*

Adapting the homepage of a business website is useful because customers receive a more tailored experience and many big businesses already do this. However, small businesses often don't have the time or resources to implement this.

I recently worked with a small pot plant distributor in Northern Ireland and as a result of changing the company's website it went from dealing with a local market to an international market. Using Google Analytics we found that a large proportion of visitors to the website were not buying and many of these visitors were from overseas. By adapting the website to offer international shipping costs, options for different currencies and languages, an increase in sales was seen and the company became an international business.

Q *What do you see as the biggest challenge for your research in this area?*

As well as marketing research for SMEs, I also carry out research for large businesses, but this tends to be the focus of many other researchers, and indeed academic publishers. So, recognition of the importance and uniqueness of SMEs is often missing. Aside from that, when working with SMEs, it is important for researchers to be able to relate to them and make links between abstract theoretical concepts and what is actually happening on the ground.

Q *What sparked your interest in this topic?*

I am passionate about how good marketing, good customer service and good customer relationships can drive profitability in business. I am also passionate about carrying out research which impacts on those businesses that contribute to my research. I find that you can make an impact more quickly and personally in SMEs.

Q *What do you enjoy most about your work?*

I enjoy meeting the people that are doing marketing day-in and day-out and learning from them. The challenge is then reflecting on everything you hear and bringing it together to spot trends and issues that run across businesses. I enjoy conveying this back to the people in business, but also to students who like to learn from more than just a textbook.

Q *How important is multidisciplinary collaboration in your research?*

This is something that is becoming more and more important to me as technology becomes so important in marketing. Collaborations with experts in computer analysis techniques are vital in order to understand the underlying processes in social media and the web in general.

Q *Why is Southampton a good place to do this kind of research?*

Southampton has been a great place to foster my research. As a research intensive university you get all the resources you need to facilitate good research; time, space, access, mentoring and money. The University of Southampton has a great reputation among UK business and this has helped me when I have been speaking to marketing people, be it in London or here in Southampton.

Q *Are there any other exciting developments coming up?*

When you're working at the interface of marketing and technology the good thing is that you never know what the next big thing is going to be. However, my next big project focuses on the social media tools that are used by 130 small businesses in the south of England. I will be looking at the impact of LinkedIn, Facebook, Twitter and blogging on profitability of the companies and advise many on how they can improve the online customer experience.

Q *What opportunities are there for early career researchers in this area?*

I have been at Southampton since 2008 and have been an early career researcher here. Looking at how technology impacts on marketing in SMEs is an area wide open for new research and there are great opportunities for young researchers to carve themselves a real niche and career in the area. It is just important to always relate what you're doing to the theory that has been around for a while; for example, even though social media is new the principles of community, sharing and relationships behind it are not.

For more information about Paul's research at Southampton, visit **www.southampton.ac.uk/management/paulharrigan**

World Wide Web success

The World Wide Web is a resource that has the potential to link every person on the planet through their computers. As it evolves, researchers at Southampton continue to develop more intelligent ways of linking us to the data we seek via the internet.

When Sir Tim Berners-Lee, Chair of Computer Science at the University and inventor of the World Wide Web, demonstrated his new ideas in the early 1990s, few could predict that it would become the dominant and universal information system we all use today. At the time, only a few visionaries had it in mind that this new innovation would link all of the world's computers and potentially all of the people on our planet.

Communication is fundamental to the human experience. The Web is now the perfect platform to support all the technologies that enable that. It is now the world's document management system; a global interlinked information system with the capacity to store all of our knowledge and, potentially, answer all of our questions. It is changing the shape of nations and giving a voice to the silent majority.

Maximise social benefit

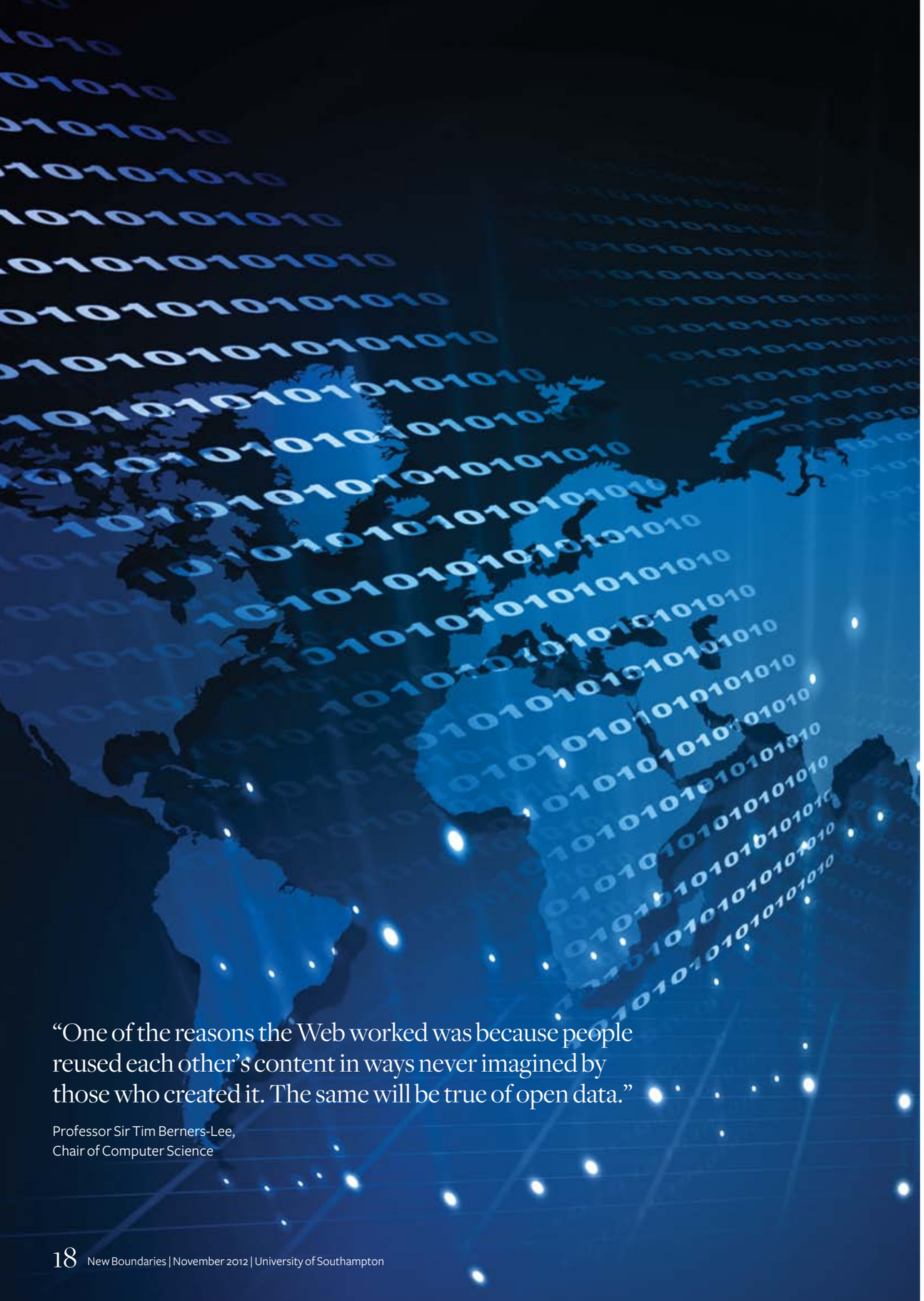
The University of Southampton has fully embraced the World Wide Web and not merely as a tool for education and research. The University's own story is inextricably linked to the emergence of both the Web and the internet. Southampton made the breakthrough in developing the low-loss optical fibres which now 'drive' the internet.

And the University continues to lead applied research into the power of the information that the Web holds and the ways it continues to transform our lives.

Professor of Web Science, Dame Wendy Hall is another of the University's Web trailblazers. Dame Wendy, whose own career has paralleled the history of the Web, is focused on understanding what the Web is and how we might engineer its future to ensure maximum social benefit. She is working with social scientists and others to study how the Web evolves while considering issues of Web security, privacy, policy and regulation.

Her work with Tim and Professor Nigel Shadbolt, who heads the University's Web and Internet Science Group, led to the creation of Web Science as an academic discipline in its own right. As one of the world's first computer scientists to undertake serious research into the internet, Wendy's academic career fits neatly alongside the history and growth of the World Wide Web. Now, she and her colleagues here are looking ahead to how the web might function in the future. Wendy predicts the rise of the Semantic Web, a more 'intelligent' way of linking us to the data we seek via the internet. ▸

Low-loss optical fibres, developed in Southampton, support the internet and the World Wide Web



"One of the reasons the Web worked was because people reused each other's content in ways never imagined by those who created it. The same will be true of open data."

Professor Sir Tim Berners-Lee,
Chair of Computer Science

Semantic Web

"We've evolved to a society where everyone looks for information first on the World Wide Web, following links to a number of documents that match search terms. You then do the 'intelligent' bit by working out which documents provide you with the information you need," says Wendy.

"That system works, but a machine can't read a document. What we're looking to do in the future is to help machines understand what's there on the Web then have processes to answer questions for you. That's the basis of what Sir Tim Berners-Lee calls the Semantic Web," she adds.

Wendy explains that the direct impact of the Semantic Web may take three to five years to become reality and even when it comes, the development may be more of a 'quiet revolution' which humans will respond to in their own unique way. "The technology is there, but the data isn't yet," she says.

Open data

In today's Web-connected world, data drives transactions and decisions of every kind, from planning a journey and anticipating the weather to choosing a house or university. Thanks to the pioneering work of Nigel and Tim, an unprecedented amount of UK government data is now freely available to the public. A range of open government data is creating new and innovative services from applications that avoid accident black spots to services that find the nearest empty car parking space.

Releasing this data has created new opportunities and made the UK a world leader in this area. In October this year the world's first Open Data Institute (ODI) was launched and marked the latest chapter in the University's continuing web success story. Co-directed by Nigel and Tim the ODI provides a wealth of public data to be used by the community of entrepreneurial developers to create applications that can empower citizens, helping them to understand and negotiate their environment.

Supporting business

Based in Shoreditch in London, a centre for many digital start-ups, the ODI will incubate, nurture and mentor new businesses to exploit the Government's open data releases. It will equip a new generation of digital entrepreneurs and developers with open data skills and will promote innovation by helping the public sector use its own data more effectively.

The ODI will support and develop the capability of UK businesses to exploit the commercial value of open data. It will also help companies explore whether their own corporate data would have more value if released as open data. "One of the reasons the Web worked was because people reused each other's content in ways never imagined by those who created it. The same will be true of open data," says Tim. "The Institute will allow us to provide the tools, skills and methods to support the creation of new value using Open Government Data."

"Using government data is not new, but the scale and ambition of this is. Making more public sector information and data available is crucial if we are to exploit the innovative talent available to us in this country to produce really outstanding applications that have social and economic value," says Nigel.

Open to all

"The vision is that current and future entrepreneurs, developers, software companies and tech businesses re-use and distribute public information in ways that add value, support transparency and facilitate new products and services that can feed back into the economy," he adds.

At a time of austerity, open data is one route to generating innovation and growth. The new goods and services that will be fashioned out of the 21st century's data will offer huge opportunities and, of course, new challenges. "There are those who fear a 'database state' – where only the powerful have access to data. But open data is open to all," says Nigel.

"Non-personal public data gathered by national and local government, when openly available, is a new public good, a new economic and social resource. The UK is well placed to exploit it and the ODI is part of that exploitation."

In the drive to free up data, Nigel and Tim argue that there are opportunities for us to benefit from the information that the government and public services collect or generate about each and every one of us: our health records, tax and welfare data, data from the education and justice systems. They believe that the right to our own individual data is something we will hear much more of in the next few years. If we gain access to that data we can expect even more powerful applications to support us all in our daily lives.

For more information on the continuing success story of the University and the World Wide Web, visit **www.southampton.ac.uk/ecs/wendyhall**

Key facts

- The World Wide Web was invented in the early 1990s by Sir Tim Berners-Lee, Professor of Computer Science at Southampton.
- In 2011 there were 3.145bn email accounts worldwide and an estimated online population of 2.2bn people.
- Our Open Data Institute will allow government data to be used to benefit the economy and society.

Web-based support for health

The internet is a tool that has the potential to help millions of people around the world. Professor Lucy Yardley, Director of the Centre for Applications of Health Psychology at the University, capitalises on this by providing web-based advice on self-management of health conditions.

Q What are the main aims of your research?

My research focuses on using the internet to help people self-manage their own health conditions. I have pioneered the development of the unique LifeGuide open source software for developing web-based interventions that encourage patients to change their behaviour in order to help them achieve a better quality of life. My current programme of research addresses the key question of how best to integrate digital support for self-management of health with existing health promotion and healthcare services.

My research programme started with an exercise-based treatment known as Vestibular Rehabilitation or Balance Retraining, which is the most effective means of treating dizziness related to inner ear problems (a very common cause of dizziness). This research has shown that simply giving booklets that explain how to do balance exercises to people with dizziness leads to reduced dizziness within a matter of weeks of starting, and the benefits last for at least a year.

Q Why is it important to research this topic?

Dizziness associated with inner ear problems is a very common condition. Dizziness is actually the second most common symptom presented in primary care, second only to pain. In large population studies, up to 25 per cent of adults report current dizziness and a screening test for poor balance due to vestibular dysfunction showed problems in 35 per cent of adults and 50 per cent of those older than 60 years. Dizziness can interfere with people's daily activities and cause stress. It also increases the risk of falling and fear of falling, which in turn, can result in substantial further limitation of activity, injury, and healthcare costs.

Q What is the biggest challenge in this area?

The biggest challenge is getting the information about the simple exercises out to patients. I first produced a simple booklet for patients detailing the exercises, but more recently we have been given funding to produce an online version of the advice booklet, so patients can click on a link and get all the advice they need.

Q What sparked your interest in this topic?

After my first degree in psychology, I completed an MSc Audiological Science degree at the Institute of Sound and Vibration Research (ISVR) at the University. It was a clinical qualification and I started working with patients that suffered from dizziness; this is when my interest in the topic began.

Q What do you enjoy most about your research?

The enjoyment is being able to help people. It is really nice to hear from patients who have found out about the simple exercises from the Meniere's Society (the self-help group that supplied the booklet), a clinic or the internet and used them with the result that their quality of life has improved.

Q Could you tell us more about other exciting developments in your research?

The LifeGuide project started four years ago with funding from the Economic and Social Research Council. But since then, we have received £1.5m funding from the Engineering and Physical Sciences Research Council to build the software into smart phones, so that even more people can have access to help and advice. We are leading this project, but collaborating with the universities of Cambridge, Oxford, Birmingham and University College London.

Other web-based interventions we are working on aim to help with other health problems such as stroke rehabilitation, management of hypertension, back pain, eczema, respiratory problems, irritable bowel syndrome and fatigue in cancer survivors (funded by McMillan).

Q What is your next project?

I have just started to collaborate with health literacy expert Professor Don Nutbeam, Vice-Chancellor of the University of Southampton, to increase the levels of health literacy in relation to diabetes across Europe. The internet has a lot of potential to help people, so we are trying to make sure the online healthcare interventions are as engaging as sites such as YouTube.

Q Is multidisciplinary collaboration important in your research?

Multidisciplinary collaboration is very important in my research. One of my key collaborators is Professor Paul Little in Primary Care and Population Science at the University, who has identified many good uses for LifeGuide interventions, and I work with many other social scientists, doctors, nurses, physiotherapists and of course computer scientists. Computer scientists have been vital in this project in order to develop the LifeGuide software, so that non-experts like me can use it to develop the web-based interventions.

Q Why is Southampton a good place to do your research?

The University of Southampton is known to be a world leader in computer science and our primary care research at Southampton University Hospital is also world class. Here in Psychology we have a particularly strong team of health psychologists and the technical support to drive these sorts of projects forward. Working together, these disciplines make an excellent combination.

For more information on Lucy's research at the University, visit **www.southampton.ac.uk/psychology/lucyyardley**

A prince of poetry

Researchers from English, together with colleagues from the Hartley Library at Southampton, are working to uncover the legacy of F T Prince, one of the University's first English professors, who is increasingly recognised as one of the most significant 20th-century British poets.

On 20 September the University honoured F T Prince's centenary with a one-day symposium that brought together poets and critics from all around the world to celebrate his work. Organised by Professor Peter Middleton and Dr Will May from the Centre for Modern and Contemporary Writing, at the University, in partnership with Professor Peter Robinson from the University of Reading, the symposium marked the opening of a major new archive of Prince's letters, journals and unpublished poems at Hartley Library.

Commemorative event

"We have admired his poetry for a long time and were aware that this year is the centenary of his birth and we decided we should put on a symposium to celebrate his work," says Peter Middleton. He explains that Prince was one of the first professors in English at the University and therefore Southampton seemed the right venue for the event. "In January, we found that he had gifted all his papers to the Hartley Library, but embargoed them for 30 years on the strict condition that they had to be kept in absolute secrecy until this year," he adds.

The archive features personal correspondence with E M Forster, W H Auden and T S Eliot and shows the high esteem in which Prince was held by some of the major writers of the 20th century. His unpublished poems also make a major contribution to our understanding of 20th-century British and American poetry.

Will explains that the aim of the symposium was to bring together those who knew Prince, were influenced by him or who were inspired by his poetry, with a new generation of poets and scholars. "It was designed to be both a celebration of his work and life, and a way of introducing him to those who have never read his work before," he says. ▸

"Prince's poetry is powerful, distinctive and challenging on its own terms. It is wonderfully varied – he wrote dramatic monologues, narrative poems and love lyrics."

Dr Will May,
Centre for Modern and Contemporary Writing

Image courtesy of the Special Collections and kind permission of the Southern Daily Echo

In addition, an exhibition at the Hartley Library in September told the story of Prince's poetry, from his first verses written when he was in a Catholic college in South Africa, through to his time at the University of Oxford in the 1930s and his years in Southampton. "Through letters, reviews and drafts, it shows us how and why his work was neglected by postwar Britain and the incredible legacy he left to subsequent generations of British, American and South African poets," Will says.

Poetic history

Frank Templeton Prince was born in 1912 in South Africa. Peter explains that he came to Britain for an education and studied at the University of Oxford. And it is here that he became interested in the Renaissance, its poetry and Italian literature. "It is clear that he always wrote poetry, because we found many poems in the archive that he wrote when he was living in Africa or when he was a student in Oxford," says Peter.

In the 1940s he joined the Intelligence Corps, working at Bletchley Park, mainly on Italian codes. It was at this time that he wrote one of his most famous poems called *Soldiers Bathing*. "It is a moving account of soldiers cooling off in the sea on a hot day," says Peter. "But it is even more poignant because it highlights the vulnerability of the soldiers' flesh and the destructive nature of war. And for this reason it is seen as one of the best poems to emerge from World War II."

He married in 1943, and in 1946 came to live in Southampton, after being appointed as an English lecturer at Hartley College, which later became the University. In 1957 he became a professor of English. "His best poems are imaginings of past events, but to some extent, what we most value him for is a series of historical poems on Caravaggio, Michelangelo, Richard the Lion Heart and many more," says Peter.

Great authority

During his time as a professor of English at Southampton he taught many students and developed the first English department that had a strong poetry focus. Christine Orme, one of his former students, remembers him well: "Professor Prince had a great presence. He was tall, slim and distinguished, always immaculately turned out. He was quietly spoken, but had an air of great authority," she says.

Prince was Christine's pastoral tutor and they met at the beginning of each term to talk about the course and any problems she may have had. She also vividly remembers him lecturing on John Milton's *Paradise Lost, Paradise Regained* and *Samson Agonistes*. "We did know that he wrote poetry, but he was a modest man and I have to admit that I didn't know how influential he was as a poet," says Christine. "However, I remember being very disappointed the first time he read an extract from *Paradise Lost* in a lecture, because although his diction was perfect, he read it with no expression. Obviously he believed in letting the words speak for themselves," she adds.

Nurturing talent

Peter explains that there are different schools of thought about how to read poetry. "The dominant one today is the tendency to add some 'emotional colouring' when reciting poetry, but another school of thought believes that the words speak for themselves and that the reader should be a conduit for the words, but not interfere with the meaning," he says. "It doesn't surprise me that Prince recited poems in this way."

Although the influence that Prince had on poetry has remained largely unknown by the general public, he has appealed to a wide variety of contemporary British and American poets. Geoffrey Hill and John Ashbery, arguably two of the most significant poets writing today, both cite Prince as the most significant influence on their work. "Not only does this make a return to his work timely, but it reminds us of the very powerful influence apparently neglected poets can have on the literary landscape," says Will.

Prince has also been known to mentor up-and-coming poets. "A number of poets have said that when they started out, they sent him their work to read and he was immensely helpful. Lee Harwood, a poet in his early seventies, living in Brighton, has many letters that were written in the 1960s in which Prince is advising him line by line on how to write poetry," says Peter. "That is a generous and time-consuming thing to do for someone you don't know," he adds.

"Prince's poetry is powerful, distinctive and challenging on its own terms. It is wonderfully varied – he writes dramatic monologues, narrative poems and love lyrics. His work is extremely inventive, especially in terms of its syntax," says Will. "The subjects of his poems also shine a light on some of the important research going on now in English at the University. His focus on African literature and culture in poems like *Chaka*, and Jewish history in poems such as *Drypoints of the Hasidim*, chimes with the work of Southampton academics Dr James Jordan, Dr Devorah Baum and Dr Ranka Primorac."

For more information on Peter and Will's research, visit **www.southampton.ac.uk/english/contemporarywriting**

For more information on the University's 60 successes, visit **www.southampton.ac.uk/60**

Discovering diamonds

Scientists from the University of Southampton have discovered a previously unrecognised volcanic process, similar to one that is used in chocolate manufacturing, which gives important new insights into the dynamics of volcanic eruptions.

"As volcanologists we treat diamonds as just another crystal, but they offer a huge amount of information on the dynamics of magma transport and eruption, and provide a unique window on the conditions in the Earth's deep interior."

Dr Thomas Gernon,
Lecturer in Earth Science

Dr Thomas Gernon, Lecturer in Earth Science at the University of Southampton, and his team investigated how a process called fluidised spray granulation can occur during explosive volcanic eruptions to produce well-rounded particles containing fragments from the Earth's mantle, most notably diamonds.

"This physical process is similar to the gas injection and spraying process used to form smooth coatings on confectionary, and layered and delayed-release coatings in the manufacture of pharmaceuticals and fertilisers," says Thomas.

Kimberlite eruptions are very rare and occur at intervals of about 50 million years. "There hasn't been a large kimberlite eruption for about 56 million years, so we could expect another phase in the not too distant future," says Thomas. "The fact that the eruptions are quite regularly spaced in time is not fully understood, but the cyclicity suggests it is in some way linked to the global tectonic cycle."

Kimberlite volcanoes are the primary source of diamonds on Earth, and are formed by gas-rich magmas from mantle depths of over 150km. Kimberlite volcanism involves high-intensity explosive eruptions, forming diverging pipes or 'diatremes', which can be several hundred metres wide and several kilometres deep. A conspicuous and previously mysterious feature of these pipes are 'pelletal lapilli', well-rounded magma coated fragments of rock consisting of an inner 'seed' particle with a complex rim, thought to represent quenched magma.

Economic significance

These pelletal lapilli form by spray granulation when kimberlite magma intrudes into earlier pyroclastic infill close to the diatreme root zone. Intensive degassing produces a gas jet in which the seed particles are simultaneously fluidised and coated by a spray of low-viscosity melt.

In kimberlites, the occurrence of pelletal lapilli is linked to diamond grade (carats per tonne), size and quality, and therefore has economic as well as academic significance. "In a typical mine you might get two or three hundred carats per 100 tonnes of excavated rock and a carat can be sold for up to $20,000, so each dump truck can carry several million dollars-worth of diamonds," says Thomas.

"The origin of pelletal lapilli is important for understanding how magmatic pyroclasts are transported to the surface during explosive eruptions, offering fundamental new insights into eruption dynamics and constraints on vent conditions, notably gas velocity," Thomas adds.

Thomas explains that the ability to tightly constrain gas velocities is significant, as it enables scientists to estimate the maximum diamond size transported in the flow. "This is very useful for volcanologists, because if you can take a sample of rock and estimate the velocity of the eruption – usually up to 100 miles per hour in each pulse – you can start to unravel the dynamics of the eruption."

Gas fluidisation and magma-coating processes are also likely to affect the diamond surface properties. Size and surface properties are of great interest to diamond producers such as De Beers, the world's largest diamond mining company, because this fundamentally affects the value of the stone. Thomas's work on this volcanic process can therefore highlight where potentially high concentrations of diamonds might be in the world's wealthiest mines, resulting in a more cost-effective recovery process.

Window to the past

The team studied two of the world's largest diamond mines, Venetia in South Africa and Letsêng in the Kingdom of Lesotho. "It is great that we are able to capitalise on the fact that these ancient volcanoes are mined extensively. As you can imagine, we can't make direct observations of active volcanic vents, so this is a great place to start. What the mines are doing is excavating into the deep interior of extinct volcanoes and this allows us as scientists to see inside, providing us with insights into what happens inside currently active volcanic systems," says Thomas.

"As volcanologists we treat diamonds as just another crystal, but they offer a huge amount of information on the dynamics of magma transport and eruption, and provide a unique window on the conditions in the Earth's deep interior," he adds. In the Letsêng pipe in Lesotho, pelletal lapilli have been found in association with concentrations of large diamonds (up to 215 carat), which individually can fetch up to tens of millions of pounds.

Considerable interest

Thomas and his team are in a unique position as they have access to the roots of a volcano. Other volcanologists working in different fields have observed supporting evidence for the spray granulation process reported by Thomas. "This gives weight to our findings and suggests that this is a generic pyroclastic process that hasn't previously been identified," he says.

Thomas explains that as well as giving scientists an insight into the processes that occur during an explosive eruption, these findings also provide new evidence for fluidised granulation in natural systems. "This will be of considerable interest to engineers and chemical, pharmaceutical and food scientists who use this process routinely."

For more information, visit **www.southampton.ac.uk/oes/thomasgernon**

In brief

Colour changing coral

Research from the University of Southampton and National Oceanography Centre Southampton has provided new insight into the basic immune response and repair mechanisms of corals.

Research has found that increased growth is the underlying physiological process associated with disease, wounding and stress-related colour changes in reef-building corals. Dr Joerg Wiedenmann, Senior Lecturer of Biological Oceanography and Head of the Coral Reef Laboratory at the University of Southampton and his team have investigated distinct green fluorescent protein (GFP)-like pigments responsible for the green, red and purple-blue colours of many reef-building corals.

By examining these GFP-like pigments in four coral species from the Red Sea, the Arabian/Persian Gulf and Fiji, they found that their presence indicates growing tissue in growing branch tips and margins of healthy coral colonies; as well as in disturbed colony parts, compared to undisturbed areas.

"Our conclusions have important implications for predictions of the negative impact of changing environmental conditions on coral reefs. Reduced coral growth rates anticipated in response to ocean acidification, warming and nutrient enrichment of coral reef waters will result in a reduced capability of the corals to defend themselves against colonisations by other organisms," says Joerg.

The hottest superconductor

Southampton researchers have made new discoveries about a remnant of an exploded star, confirming long-held scientific theories for the first time and pushing the boundaries of knowledge about our Universe.

When a massive star runs out of nuclear fuel, it undergoes a supernova explosion and the remains form either a neutron star or a black hole. Our scientists have been studying the central object in Cassiopeia A, a neutron star that resulted from a supernova whose light reached the Earth over 300 years ago.

Professor Nils Andersson, Head of the University's General Relativity Group, says: "Researchers have always thought that these objects would be superfluid [have no internal friction or viscosity] and superconducting [able to conduct electricity with no loss of energy]. We now have clear observational evidence that supports these ideas."

Using theoretical models and observations from the Chandra X-ray Observatory spanning 10 years, Southampton researchers were instrumental in identifying the object as a neutron star and in measuring its carbon surface composition.

Nils explains: "Follow-up work has shown that the neutron star is cooling in real time. The observed cooling rate provides the first evidence that the star's interior is superfluid and superconducting. These findings are all first-time discoveries in astronomy."

Fossil fuel free ships

A Development is underway to design the post-industrial world's first 100 per cent fossil fuel free sailing cargo ship using testing facilities at Southampton.

With rising fossil fuel prices and the global challenge of reducing greenhouse gas emissions, the shipping industry needs efficient and affordable low-carbon ships. Now B9 Shipping, part of the B9 Energy group of companies, is developing a full-scale demonstration vessel that uses a state-of-the-art dyna-rig sail propulsion system with an off the shelf Rolls-Royce engine powered by waste derived liquid biomethane.

The fundamental testing programme that begun in June, is being conducted at the University of Southampton's Wolfson Unit for Marine Technology and Industrial Aerodynamics. It involves tow tank and wind tunnel research to identify a basic hull design, while examining various options in the performance parameters of a B9 Ship in scale model, calibrating the thrust from the sailing rig with various hull shapes to secure optimum performance efficiencies in a wide range of conditions.

Kevin Forshaw, Industry Liaison for the newly formed Southampton Marine and Maritime Institute (SMMI) at the University of Southampton, says: "Helping to develop viable means of propulsion for shipping in a post-carbon economy is a strategic objective for SMMI, and the B9 concept offers a viable alternative that we will be seeking to support at every opportunity."

Helping archaeologists around the world

Non-invasive techniques help archaeologists learn more about underground conditions without the expense and disruption of excavations. At Southampton, our researchers have developed considerable expertise in a wide range of these techniques and collaborate with archaeologists all over the world.

Angus Graham of the Egypt Exploration Society engaged Kristian Strutt, Head of the University's Archaeological Prospection Services (APSS), to carry out geophysics work on the site of ancient Thebes on the Nile near Karnak, including the enormous basins known today as Birket Habu and Birket Luxor.

The University of Southampton's Electrical Resistivity Tomography (ERT) equipment (a technique for imaging sub-surface structures) has revealed evidence of channels that may have fed Birket Habu. "This is sophisticated kit and essential for us as we wanted to gain an understanding of the geomorphological origins of the site of Karnak," says Angus. Magnetometry was also used to map features near the surface and there are plans to use Ground Penetrating Radar in future years.

Kristian has also worked on the Egyptian site of Antinoupolis with archaeologists from the Antinoupolis Foundation and the University of Florence. The city was founded by the Roman Emperor Hadrian on his imperial tour of Egypt in October of 130AD. Earlier remains on the site include a temple from about 1250BC from the reign of Ramses II.

In brief

Placebo effect

Research carried out at the University of Southampton has concluded that participants in drug trials should be better informed about the potential significant benefits and possible side-effects of placebos.

Placebos are traditionally thought of as 'inert' pills, given in trials to act as a yardstick or constant by which to measure the effects of new 'active' drugs. However, placebos themselves have been shown to create substantial health changes in patients.

"We believe the health changes associated with placebos should be better represented in the literature and given to patients before they take part in a clinical trial. At the moment these effects are largely being ignored in the patient information leaflets," says lead researcher at Southampton, Dr Felicity Bishop.

The research team, led by the University of Southampton in collaboration with Harvard Medical School and Northern Arizona University, examined the wording of 45 participant information leaflets from clinical trials which used placebos and are listed on the UK Clinical Research Network Database.

The study showed the target treatments were prioritised over the placebo. Professor of Health Research at Southampton, George Lewith, comments: "The leaflets largely ignored the overwhelming evidence that placebos can actually have significant and sustained effects on people. This could affect the treatment beliefs and expectations of those volunteering for studies and in turn the results."

Supporting innocence

The University of Southampton has received generous support through funding from the Jomati Foundation, a UK registered charity that focuses on providing assistance in the area of legal education and access to law, to enhance research into wrongful criminal convictions.

The Innocence Project is a student-led extra-curricular educational project, affiliated to the Innocence Network (UK) and based in the Southampton Law School. Coordinated by Dr James Maclean, students are involved in objective and independent investigation of real criminal cases of prisoners who maintain their factual innocence, but have exhausted their legal appeals.

With assistance from a practicing lawyer research is carried out on cases to achieve a referral back to the Court of Appeal via the Criminal Cases Review Commission (CCRC) or, if evidence of factual innocence does not constitute legally admissible grounds of appeal, for application to the Secretary of State for consideration for a Free Pardon under the Royal Prerogative of Mercy.

"This project with the Innocence Network gives students valuable experience of the world of work as well as the criminal justice system. Our teams develop transferable skills of research and analysis that any employer will appreciate when our students graduate," says James.

Imaging the world

Southampton scientists are able to analyse very small samples and identify chemicals at low concentrations in a wide variety of situations from crime scene analysis to genetic mutations that cause diseases.

Surface Enhanced Raman Spectroscopy (SERS) is an analytical technique that provides information about the structure and behaviour of molecules by analysing the way they vibrate on a surface when they interact with light.

A team of researchers at the University are now using SERS to help healthcare professionals and detectives. "At Southampton we are currently using SERS to understand more about DNA fingerprinting and the genetic mutations that lead to conditions such as cystic fibrosis," explains Professor Phil Bartlett of Southampton's Electrochemistry Research Group. "Also, one of our students is developing SERS applications for crime scene investigations."

SERS has also been developed for the identification of diseases such as cancer and Alzheimer's in biological samples and the detection of anthrax and environmental pollutants, to name just a few examples. It has also been used in the field of art conservation, helping restorers to identify the substances used in pigments.

'Mixed' family cultural heritage

The mothers of Britain's 'mixed families' are ensuring their children learn about their heritage and culture, according to a collaborative development project between the University of Southampton and London South Bank University. Findings show that even if a child's father hails from a minority background, it will still be the mother that takes responsibility for teaching them about the father's culture.

In a new initiative funded by the Economic and Social Research Council (ESRC) and conducted with the relationship support organisation OnePlusOne, researchers have used their recent research findings on 'mixed' relationships to develop online resources that raise awareness about the sorts of issues 'mixed' couples may face and to provide relationship support where needed.

"Once people come together in a 'mixed' relationship, we know that maintaining that relationship can be challenging for some couples, often because of other people's attitudes," says Southampton researcher, Professor Rosalind Edwards.

"The issues that they may face can include having to deal with others' disapproval, and in some cases, the exclusion from family and friends. Clearly, this can create stresses in their relationship and, based on our research, we provide examples of some of the successful strategies 'mixed' couples have employed to cope with these problems," she adds.

For more information on these stories, visit **www.southampton.ac.uk/research**