

#01 Summer 2012

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STARING INTO SPACE

GALAXIES
7,000,000,000
LIGHT YEARS AWAY

A STICKY BUSINESS

AN ECO-FRIENDLY
GUM HITS THE
STREETS

hidden extras

AUGMENTED REALITY

WATCH AS THIS
MAGAZINE
COMES TO LIFE!



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REALITY



Welcome to the first issue of Discover More. By covering as broad a field of subjects as possible, our aim is to provide an insight into some of the exciting activities happening at Bristol – we hope there will be something of interest in each issue for all our readers. We've been fortunate to have had a lot of input from sixth form pupils in the creation of this magazine, and I would like to thank them for their insight, ideas and energy.

If you have any suggestions that could help with the on-going development of the magazine, please email discovermore@bristol.ac.uk. We are also very excited to be able to include elements of augmented reality in the magazine – more about this above – and Discover More is also available as a free downloadable app; simply search for 'Discover More magazine' in the app store. We hope you enjoy this first issue.

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discover more OUR HIDDEN FEATURES



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Using a smartphone or tablet in conjunction with elements of this magazine will take you to what can only be described as another level. To begin with, you'll need to download the free 'Discover More AR' app in the app store. Then keep a look out for the Discover More augmented reality logo (above) and simply 'hover' the camera on your device above that page. We haven't made it too obvious which image is linked to AR, but once you've found your target, you can interact with the magazine in a way that could well become the norm in the future. Just remember where you saw it first! We'd really like your feedback on this augmented reality feature – was it interesting and/or fun? Please send your comments to discovermore@bristol.ac.uk.

In addition to this groundbreaking feature, on the back page you'll find one of the UK's first uses of a Quick Response (QR) code embedded within another image – anyone spot a Bristol landmark? Simply download a free QR app to begin.

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Don't forget to download your **FREE** Discover More augmented reality app. Search for 'Discover More AR' in the app store, then look out for the smartphone logos throughout the magazine.



Photo: Andrew Higginson/Bristol University



When threatened, the caterpillar of the large white butterfly is prone to being sick.



A pet is for life?



IT SEEMS THE RECESSION is hitting more than just human members of the family. Research carried out by the School of Veterinary Sciences found that over a quarter of a million cats and dogs were taken in by UK rescue organisations in 2009, as hard-pressed families struggle to pay for animal food and costly trips to the vet.

Welfare organisations were asked to provide details of the animals they had in care, with findings showing that **131,070 cats** and **129,743 dogs** entered the care of UK welfare organisations during 2009.

Dr Corinna Clark, a researcher in the University's Animal Welfare and Behaviour research group, said: "As well as highlighting the enormity of this issue, the study demonstrates the substantial efforts of welfare organisations in caring for and rehoming unwanted animals annually, many of which rely on unpaid help from volunteers. We will continue to support the work these organisations do through our collaboration with them."

With friends like these

ANIMALS DEFEND THEMSELVES in a number of ways – pretending to be something else, changing colour, attacking with sting or bite. But one novel method, vomiting over your foe, is the preferred method of large white butterfly caterpillars.

Researchers from the Universities of Bristol and Liverpool have found that, perhaps in the interest of neighbourly relations, these caterpillars are less likely to vomit on predators if they're in a group. The caterpillars rely on safety in numbers

so their own likelihood of having to vomit on a predator is reduced. Their reluctance is understandable, as the loss of food can slow down growth and reduce survival rates.

Dr Andrew Higginson of Bristol's School of Biological Sciences said: "This study helps us to better understand the defences of many caterpillars and similar insects, several of whom are important crop pests. It will ultimately help in the design of more sustainable methods for reducing crop losses experienced by farmers."

Rewriting history

Archaeologists from the University of Bristol have discovered that what was once thought to be an ancient standing stone is actually the capstone, or entrance cover, of a **5,500-year-old tomb**. Dr George Nash and his team (right) carried out the

first full investigation of the **1.2m high Trefael Stone**, which is located near Newport in South Wales. Findings, which included beads likely to be early Mesolithic and the remains of human bones, make the site Wales' earliest Neolithic burial-ritual monument.

The site has added significance because farming practices since the 17th century mean most sites of this age have been destroyed. Dr Nash: "The excavation of this monument gives us a rare insight into Britain's earliest farming communities. What is more significant is the survival of pottery and human bone from this period within such acidic soils."



TAKING THE STING OUT OF IT



If you're unlucky enough to upset a bee, it's likely to react in a way that can make you yelp. But scientists are now using the powerful toxin found in a bee's sting to help design more effective drug compounds.

NEIL MARRION, PROFESSOR of Neuroscience at the School of Physiology and Pharmacology, explains how the toxins in that very bee sting could be used medically.

"My research group has been interested in the clues that a toxin found in the venom of the honeybee can give to how a protein can be targeted therapeutically. We are interested in a protein known as an SK channel. A channel is a protein embedded in the cell membrane that can open to provide a pathway for ions, such as potassium, to leave the cell.

"There are three types of SK channel and they are found in different parts of the brain and in some parts of our body, like the heart. We have recently published a study in the Proceedings of National Academy of Sciences USA (PNAS), which will

enable the design of more effective drug compounds to enhance activity in specific nerves. We have found how the SK channel folds itself in the cell membrane, telling us how the shape and composition of the surface will look to a drug molecule." ●



Ouch! Honeybees have one sting, which they'll use if threatened.

UNDERGRADUATE RESEARCH

Professor Marrion actively encourages undergraduates to undertake research that can be published in scientific journals. For example, an undergraduate helped on a project that looked at the effects of cholesterol on an ion channel, which was later published.

Another undergraduate, who studied the effect of statins (drugs used to lower cholesterol levels) on cognition, then built upon this research. In collaboration with Dr Emma Robinson, the student found that administering a statin caused a loss of memory and cognitive ability. This ties in with an increasing amount of data that shows statins have cognitive side effects. This work is currently being written for publication and is the seed for a new PhD project.

PLEASE NOTE!

Although to begin with the collection of honeybee venom involved actually removing the venom glands from worker bees, thankfully scientists are now using a synthetic apamin that is made in the laboratory. Good job too, as disease, pesticides and adverse weather have meant the UK's honeybee population has fallen by 10-15 per cent in the past two years!

Vaccines – the unsung heroes

In the 1990s, **Professor Adam Finn**, from the Department of Cellular and Molecular Medicine, was involved in a series of studies into the causes of meningitis C. This work led to a vaccine that has become part of the immunisation programme for young people.

Just over ten years since this began, there has been a complete disappearance of meningitis C, which at one stage had accounted for roughly 40 per cent of meningitis cases. However, despite this remarkable success, meningitis B is still 'at large', which has led to the current series of studies that researchers from the University of Bristol have been involved in.

The purpose of this study was to find whether a vaccine could reduce meningitis disease by stopping transmission between the throats of young people. "There are a number of new vaccines being introduced to protect against meningitis caused by the

germ *Neisseria meningitidis*," says Professor Finn. "Different types of this bacterium can cause disease in people, but they all cause disease by spreading from person to person by 'colonising', or lodging in, the throat."

Now this may not be the kind of pre-university information you wanted to read, but, rest assured, throat colonisation is very common amongst young adults, with about a quarter of them carrying the bacterium. Fortunately, only a tiny minority, about one in 10,000, will go on to develop meningitis.

"We already know that when these vaccines are injected into young adults, the blood produces antibodies that protect against meningitis," continues Professor Finn. "But what we need to know is whether these vaccines can also act by stopping the *Neisseria meningitidis* bacteria from colonising the throat. In this case, it is hoped that the vaccine will result in 'herd immunity' – where a vaccine works by altering the overall success of a pathogen



in spreading among a population.

This type of research can have a very direct influence on public health policy, and, as the success of the meningitis C vaccine has shown, researchers are able to enhance people's lives in a positive way.

Professor Finn concludes: "If you go to the cinema and look around you, about half of the people you can see wouldn't be there if it wasn't for vaccines – this kind of work doesn't often get the credit it deserves!" ●

Above: Young people are particularly susceptible to meningitis.

human rights

5

History in the making

The Human Rights Implementation Centre is based in the School of Law at the University of Bristol. The centre develops expertise, advice and scholarship on the role of institutions in the implementation of human rights at a national, regional and international level.

THE CENTRE'S EXPERIENCE in organising events with representation from national human rights institutions (NHRI), politics and civil society meant it was ideally placed to bring together major players from last year's 'Arab Spring'. This event, which took place in Cairo in December 2011, gave representatives from NHRIs in Algeria, Egypt and Morocco, as well as civil society organisations in Egypt, Libya and Morocco, the opportunity to examine the role NHRIs can play when the usual political, judicial and other systems are disrupted.



Professor Rachel Murray, director of the Human Rights Implementation Centre: "We were prompted to hold this event as a result of the Arab Spring and the impact that this had on national human rights institutions in north Africa. Given recent events in Egypt and Cairo, our event was particularly timely."

The seminar, 'Strengthening the Capacities of National Human Rights Institutions in North Africa in Conflict and Post Conflict Situations', looked to investigate the role of NHRIs during and after times of conflict, when operating can become particularly difficult.

Professor Murray: "NHRC Secretary General Ambassador Karem noted that the event had

demonstrated the strong determination of NHRI members to seize the momentum for change and spare no efforts in protecting the rights, freedoms and dignity of people across the region." ●

Above: Egyptian protesters out in force.

AN AWESOME SUBJECT

While studying for her PhD in Earth Sciences at the University of Bristol, **Lorraine Greenwood** visited the Afar region of Ethiopia in order to research the activity of the Erta Ale volcano.

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AS AN IGNEOUS petrologist, I look at volcanic rocks and study how they've been formed. My field area, the Afar desert region of Ethiopia, is one of the world's hottest places – temperatures can reach 65°C in the summer! It's an incredible place, as three of the earth's tectonic plates – the Red Sea, the Gulf of Aden and the Main Ethiopian Rift – are pulling apart.

It's also one of the least accessible, meaning our trips take a great deal of careful planning. The research team consists of scientists from five British universities, and also has links with universities in the

US, Ethiopia, France and New Zealand.

One of the most remarkable trips we've taken was to the Erta Ale volcano, which lies in the north of the region. Erta Ale means 'smoking mountain', and is aptly named as the volcano has a permanent lake of molten lava in a pit about 20 metres below the surface of the crater, which leads to a plume often rising above the volcano.

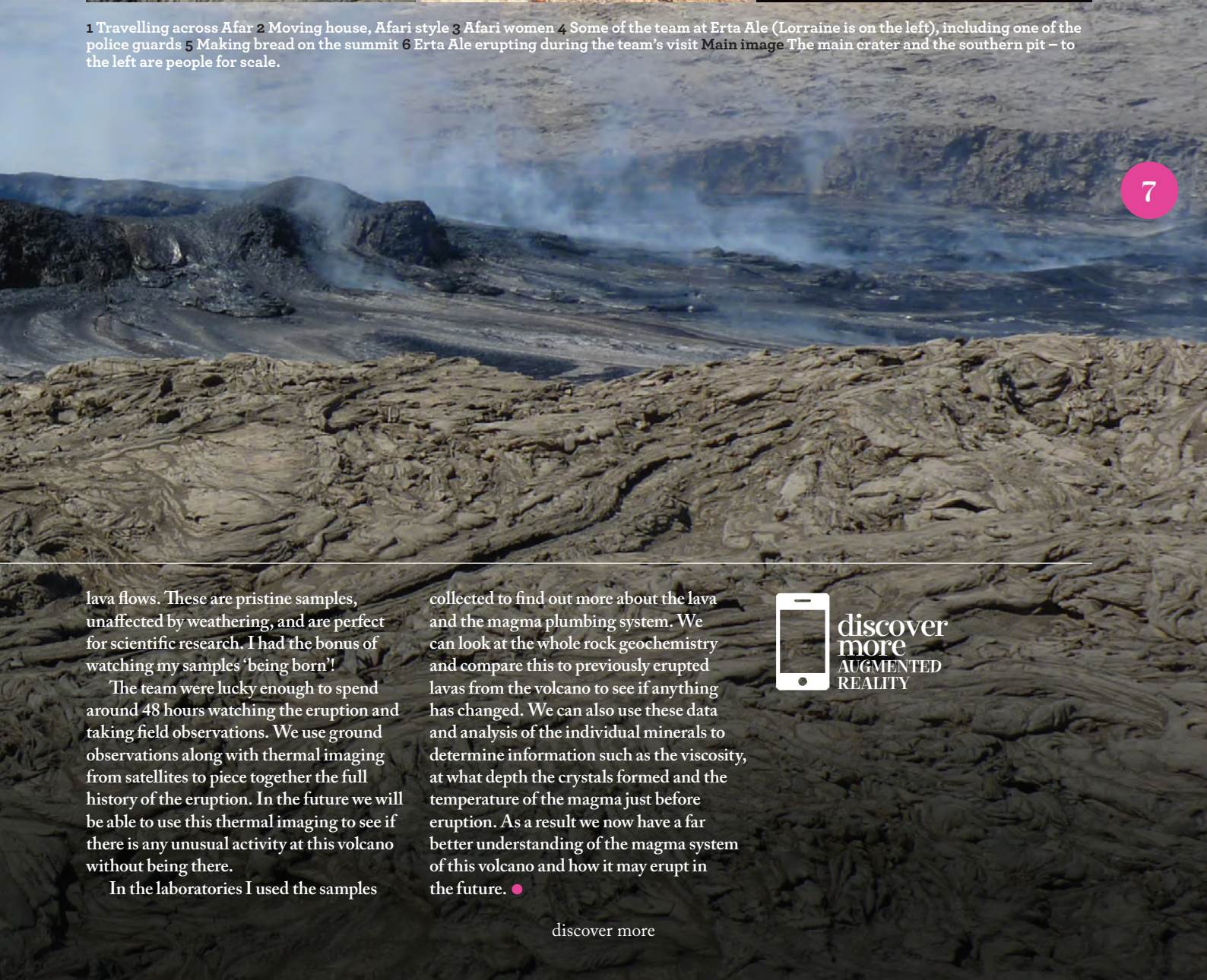
Trips to the region are always an adventure. The numerous lava flows make some areas inaccessible even by four-wheel drive, which means one of our main methods of carrying equipment is camel.

As part of the project I'm working on we have installed a network of seismometers across Afar, which measure earthquakes triggered as the tectonic plates move slowly apart. As the area is too remote to inhabit permanently the equipment is left on location to monitor activity, with a trip to the area every six months to see what's been happening.

It was one of these service trips that I was part of, going along as a field assistant. On arrival we found the volcano was erupting and the lava lake had risen – I was able to take 'zero age' samples from the erupted



1 Travelling across Afar 2 Moving house, Afari style 3 Afari women 4 Some of the team at Erta Ale (Lorraine is on the left), including one of the police guards 5 Making bread on the summit 6 Erta Ale erupting during the team's visit Main image The main crater and the southern pit – to the left are people for scale.



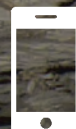
7

lava flows. These are pristine samples, unaffected by weathering, and are perfect for scientific research. I had the bonus of watching my samples 'being born'!

The team were lucky enough to spend around 48 hours watching the eruption and taking field observations. We use ground observations along with thermal imaging from satellites to piece together the full history of the eruption. In the future we will be able to use this thermal imaging to see if there is any unusual activity at this volcano without being there.

In the laboratories I used the samples

collected to find out more about the lava and the magma plumbing system. We can look at the whole rock geochemistry and compare this to previously erupted lavas from the volcano to see if anything has changed. We can also use these data and analysis of the individual minerals to determine information such as the viscosity, at what depth the crystals formed and the temperature of the magma just before eruption. As a result we now have a far better understanding of the magma system of this volcano and how it may erupt in the future. ●



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TAKING THE STICK OUT OF GUM

As anyone who has ever sat on discarded chewing gum knows, the sticky mess is a nightmare to try and remove. Freeze it? Wash it? Pick it? That quandary could now be over with a major technological breakthrough from Revolymer, a spin-out company from the University of Bristol.



Main picture: Snared by gum, we've all been there!
Inset: Professor Terry Cosgrove, gum inventing polymer expert.

THIS 'CLEAN GUM' – which was launched into the US gum market in 2010 – can be removed easily from shoes, clothes and even hair. And, in great news for local councils trying to keep their pavements clean, more than 50 per cent can be removed by conventional street cleaning techniques, with the gum degrading into biodegradable products and inert material.

The compound used in this new gum was invented by Terry Cosgrove, a chemistry professor and polymer expert from the University of Bristol. Professor Cosgrove: "This is like a dream come true for me, seeing academic research result in a real commercial product. The advantage of our clean gum is that it has a great taste, it is

easy to remove and it has the potential to be environmentally degradable."

The multi-billion dollar US gum market accounts for over 300,000 tons of chewing gum sold each year. Unfortunately, this also equates to a residual 120,000 tons of chewing gum leftovers remaining in the environment. The new gum, marketed as Rev7, is available in peppermint and spearmint flavours, and looks set to change the chewing gum industry significantly.

Chris Tamillo, who launched Rev7 in the US, said: "There is both an appetite for this new brand in the US and a willingness to provide consumers with a product that is better for the environment but does not sacrifice quality." ●



REVOLYMER

Formed in 2005, Revolymer has its roots firmly in Bristol. The company, which has a major research facility in north Wales and employs 32 people, focuses on developing new polymers with enhanced physical properties manufactured from existing commodity polymers. These new materials are being used to create commercial opportunities in cosmetics, surface coatings and laundry products, and have the potential to change the way products, such as chewing gum, are used every day.

Why does it work?

The gum most people chew is made from synthetic rubber and is hydrophobic (water repelling). These are cheap to produce, stay soft when chewed and have a long-lasting taste. However, the problems start once the chewer has had enough of that piece of gum.

This new 'clean' gum is based on an amphiphilic material that includes both hydrophobic and hydrophilic (water absorbing) properties. This means that, over time, the discarded gum absorbs and retains water, which reduces its stickiness.

A LEAP OF THE IMAGINATION

Imagine studying galaxies almost seven billion light years away. That's the day-to-day role of the astronomers who have discovered a gigantic assembly of galaxies, an almost unimaginable distance from Earth.

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THIS NEW DISCOVERY is the first time such a prominent galaxy structure has been observed in the distant universe, and was made possible through the combination of two of the world's most powerful ground-based telescopes – the VIMOS instrument on the European Southern Observatory's Very Large Telescope and FOCAS on the National Astronomical Observatory of Japan's Subaru Telescope.

The research team – which includes Ben Maughan from the HH Wills Physics Laboratory at the University of Bristol, as well as members from universities and space observatories in the US, Germany and Japan – used the telescopes to obtain a three-dimensional view of the structure by measuring the distance from Earth to over 150 galaxies.

The scientists were able to identify dozens of groups of galaxies surrounding a main galaxy cluster, with each typically ten – and some up to a thousand – times as massive as our own Milky Way galaxy.

“This is the first time that we have observed such a rich and prominent structure in the distant universe,” says Masayuki Tanaka from the European Southern Observatory. “We can now move from demography to sociology and study how the properties of galaxies depend on their environment, at a time when the universe was only two thirds of its present age.”

“In addition to the galaxies that map out this huge structure the biggest clumps are filled with a gas so hot it glows in X-rays,” said Ben Maughan. “This glow is shown in green on the image. We used XMM-Newton, the European X-ray satellite, to study the X-ray glow from this structure.”

“Students from the University of Bristol analysed the data for their final year project, and measured the temperature of the gas in each clump. These temperatures are the best way of determining the masses of the clumps and helped us to determine which pieces of this amazing structure are held together by the force of gravity.” ●

THE VERY LARGE TELESCOPE

Situated in Chile in South America, the Very Large Telescope is the flagship of European astronomy. Each of its four telescopes can see objects four billion times fainter than those seen with the naked eye. Take a look at the European Southern Observatory's website for more – www.eso.org/public/news/eso0941/

Pictured: The Milky Way from Earth. The Bristol team's research looks at galaxies up to a thousand times larger than our own galaxy.

It's impossible to stand still!

Everything in biology oscillates, whether it's the microsecond rhythms of firing cells in the brain, the daily rhythm of sleeping and waking, or the monthly rhythm of a menstrual cycle.

STAFFORD LIGHTMAN, Professor of Medicine at the University's School of Clinical Sciences: "We have been working on what makes hormone levels oscillate, and working with colleagues in the Department of Engineering Mathematics we find that there are simple feedback/feedforward mechanisms between the pituitary gland found just under the brain and the adrenal glands which make your stress hormones."

Rather like old-fashioned showers or air conditioning systems, if there is a delay in feedback about the change in temperature you get an oscillating pattern of temperature going from too hot to too cold and back to too hot. The same happens with hormones

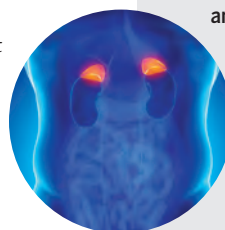
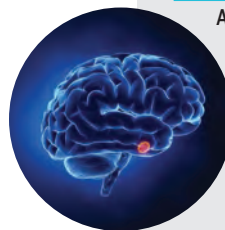
that feedback on the brain or pituitary gland and result in ultradian (less than hourly) rhythms of hormones. This then allows the body to use a digital – as opposed to an analogue – system of signalling to the tissues in the body that the hormones circulate to.

"Drug companies have classically planned their research and development around making new, more powerful drugs that they can patent," continues Professor Lightman. "The knowledge that timing of drug administration may be just as important as the potency of the drug itself should take us in a new direction in which we can modify the timing of drug administration to maximise the wanted effects and minimise unwanted side effects of drugs. This could transform the way we use drugs such as the powerful steroids that are administered for many inflammatory diseases." ●

THE PITUITARY GLAND AND ADRENAL GLAND

Although the pituitary gland in humans is no bigger than a pea (top image), hormones produced by this gland are important to many body processes, including growth, blood pressure, elements of pregnancy and childbirth, breast milk production and the conversion of food into energy.

The adrenal glands are located above the kidneys in humans (below image), and are slightly different shapes to one another, one triangular, the other semi lunar. They release hormones when the body is stressed, and also affect kidney functions.



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organic synthesis

Building blocks for the future

A new way of constructing molecules – which could speed up the development of new drugs for today's incurable diseases – has been developed by a team of molecular builders from the University of Bristol.



FROM THE PILL taken for heart disease to the insecticide used in the production of the food we eat, the creation of complex organic molecules from simple building blocks is gaining increased application in many aspects of our lives.

But the creation of complex organic molecules, known as organic synthesis, isn't an easy path. Professor Varinder Aggarwal, from the University's School of Chemistry, explains: "Organic synthesis involves the piecing together of smaller organic building blocks until the target molecule is created. However, in organic synthesis the two ends of the building blocks must first be made to attract one another. Once bonded, this new molecule is then used again in another reaction with a different building block, and so on and so on."

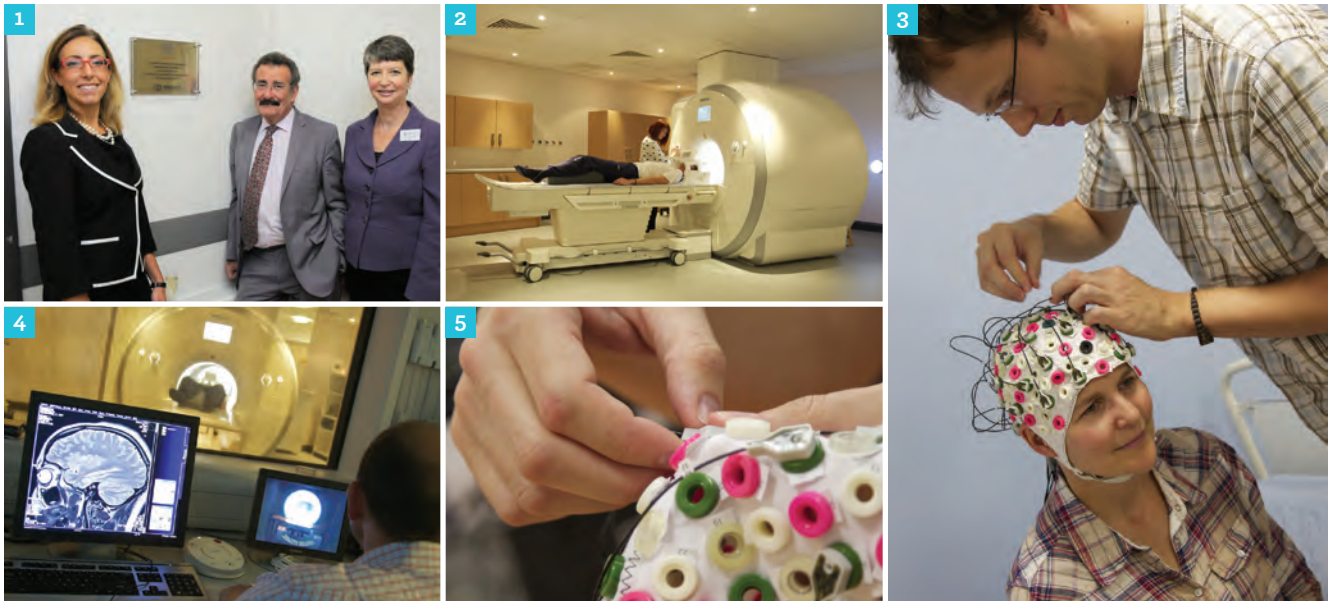
As the molecule's size and complexity increases, unwanted compounds are

formed in addition to the desired molecule, which has to be extracted before the next step.

Bristol's team of chemists have found a way of activating certain building blocks for a particular site, and, in addition, the product is ready to react with the next building block without the need for further activation. This limits the formation of unwanted compounds.

"As the starting molecule passes down the assembly line, building blocks are added sequentially with extraordinary precision so that at the end of the process a complex molecule is created with specific shape and functionality. The potential for these molecules would then be limitless, from medicine to communications devices, they could shape our future lives." ●

Left: A reaction similar to that carried out during the assembly line synthesis, the combination of two building blocks.



1 Professor Lord Robert Winston, flanked by co-directors Dr Chiara Bucciarelli-Ducci and Dr Diane Crawford, officially opening CRICBristol 2 & 4 The Siemens 3T Magnetom Skyra MRI scanner in operation 3 & 5 Worn during sleep, the 64-channel EEG cap records brain waves to index the stage of sleep the participant is in.

WHILE YOU WERE SLEEPING

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Bristol's new £6.6m Clinical Research and Imaging Centre (CRICBristol) is a joint venture between the University of Bristol and the NHS, and boasts a state-of-the-art MRI scanner, as well as a two-room sleep laboratory and four clinical investigation suites.

THE CENTRE WILL support local, national and international research, with studies ranging from neonatal MR imaging and functional brain imaging, to sleep disorders in children, adults and clinical populations. With a direct link to St Michael's maternity hospital, the facility has been purpose built and designed for studies in babies and children as well as adults.

The MRI scanner can be used for research into mood disorders such as anxiety and depression; addictions to alcohol and drugs; and strokes and dementia. This it does by monitoring blood flow in the brain and identifying changes in brain activity. Research will also look into the use of stem cells in heart repair, and new cardiac surgery procedures to monitor the heart's blood flow in children and adults.

Dr Chiara Bucciarelli-Ducci, Consultant Senior Lecturer at the School of

Clinical Sciences, and co-director of CRICBristol: "The centre provides an exciting opportunity to study our bodies and learn more about how we can live healthy lives and develop better treatments for disease. We host innovative and collaborative research, both clinical and academic, with multi-disciplinary teams. Among its facilities, CRICBristol includes a high performance computer suite where workshops and tutorials on MRI analysis are organised.

"Our students are sometimes invited to volunteer to contribute to research studies. Already, undergraduate students in psychology and medicine have volunteered for MRI studies of the function of their brain while undertaking specific tasks.

Also, postgraduates undertaking a masters in neuropsychology have been involved in research studies assessing cognitive impairment after brain injury for their dissertation." ●

SLEEP LABORATORIES

How do they work?

CRICBristol's sleep rooms are fitted with polysomnographic recording equipment, which records biophysical changes in the subject during sleep. The rooms also include infrared video plus sound recording and monitoring facility. Light and sound protected ports connect each room to the monitoring and observation room which, among many other uses, make them suitable for use by patients who need overnight assistance with breathing.





12

The bigger picture

People used to think that three years at university meant the occasional lecture but considerably more time at the union bar. While there's still time to enjoy yourself, more and more students are also taking part in extra-curricular activities that not only broaden their minds, but look great on a CV.



FRIENDS OF ALALAY

Former Bristol student Annie Syrett has raised thousands of pounds for the Friends of Alalay, the charity she founded to help Bolivian street children.

"The MSc in International Development proved to be very supportive of my charity work, in that it introduced new ideas and enabled me to challenge the ways in which I ran my charity. This applied particularly to the ways in which I looked at and approved (or didn't!) new proposed projects.

While I'm fundraising, I make dozens of presentations – the course made me far more confident when making these. I've raised around £60,000 so far but I've got so many different ideas for investing this limited resource that I've had to become more analytical and less sentimental when I set up projects and decide where the money can be best used."



MANY STUDENT UNIONS help those attending university to get involved in voluntary activities. The University of Bristol Students' Union is no different, and has long been instrumental in encouraging students to join or set up such projects. Currently, there are about 35 student-led schemes within five categories – children and youth projects, school projects, projects for older people, disability and health projects, and awareness raising and student support. In short, you're sure to find something that suits both your curiosity and energy.

Two examples of these Union-affiliated projects are Jazzhands and Pitstop. Jazzhands involves a group of students visiting residential homes each week, where they sing well-known songs and chat over a cup of tea. Undergraduate Louise Burfitt tells her story: "I don't think I'm exaggerating when I say that being part of Jazzhands was the highlight of my second year. It made me realise what a two-way process volunteering is: it's beneficial not only for those we interact with, but us as well."

Students volunteering for Pitstop run day trips and residential weekends for young people with learning difficulties. "While at Bristol it's

very easy to get trapped in the 'uni bubble', so this is a fab way of getting out and realising there's more out there," says volunteer Lucy Howard. "Seeing autistic teenagers go out of their comfort zone and try new things – for example, rock climbing or high-speed boat rides – was really inspiring."



Universities sometimes reward students who dedicate time to voluntary causes. Time spent volunteering while a University of Bristol student can count towards the Bristol PLuS Award, which recognises students who have gained skills through activities in addition to their course. To achieve this, students must complete 50 hours of non credit-bearing work experience or voluntary work, attend four employability skills-related workshops and complete an intensive skills activity.

In its third year, the Bristol PLuS Award has attracted over 1,000 students in 2011-12. Jeff Goodman, Director of Student Services and Employability, says: "A good number of students want to do something useful while they're here. This gives them the chance to help out and contribute in a fun environment. It's also a great way for them to meet other like-minded students." ●

THE BRISTOL PLUS AWARD

The award has had rave reviews from employers offering work experience.

Zurich

"In these competitive times, the ability of a potential employee to demonstrate success both academically and in extra-curricular fields is a key differentiator. Knowing a candidate will not only be technically competent, but has proactively taken part in corporate responsibility activities, means Zurich in the UK holds the Bristol PLuS Award in high regard."

NHS Graduate Scheme

"We believe it is important to work closely with universities to help students develop their employability to ensure they have a better chance of securing employment when they graduate. Our experience with the students from Bristol has been very positive."

STRENGTH THROUGH UNITY

The slightest alteration in the way materials are manufactured can lead to enormous benefits, and it's partly with this in mind that people at universities around the world are seeking to change the products around us.

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THE COMBINATION of two or more materials to enhance properties like strength and durability is nothing new, but technology is continually taking research into these combinations – or composites – to new and exciting areas.

Tennis rackets, aeroplane wings and wind turbines are all examples of products that have superior strength due to the combination of materials.

One important area of composite research looks at materials that can repair themselves – or self heal – when scratched, cracked or broken, rather than relying on human intervention.

Engineers have long looked to the human skin's ability to heal itself, with small abrasions and cuts healing within days, and even more serious wounds often able to heal completely, perhaps with just slight scarring the only reminder. The messy and time-consuming process of mending a man-made material, patching up a puncture on a bicycle tyre for example, would be made obsolete if the manufacture of self-repairing tyres were possible.

Current self-healing hot topics include Highway A58, the first self-healing

road surface, and concrete that self-heals using bacteria.

When water gets into the cracks in concrete, the aggressive chemicals it carries can start a destructive process that ends in either time-consuming repair or expensive replacement. However, much as living bone can heal its own hairline fractures, concrete could soon include bacteria that become active when mixed with water – meaning cracks and small holes could self heal – thus preventing problems further down the line.

Dr Richard Trask, lecturer in the Department of Aerospace Engineering at the University of Bristol: "A broad spectrum of industries, both in the UK and around the world, will be impacted by the developments underway, including aerospace, automotive, microelectronics, architecture, civil infrastructure and everyday consumer items."

The partnership between the University of Bristol and internationally recognised engineering firms looks set to boost the West's already enviable engineering pedigree, with members of the University a vital part of this. ●



THE BRISTOL AND BATH SCIENCE PARK

The importance of research into composites led to the 2011 opening of the National Composite Centre (NCC) as part of the new Bristol and Bath Science Park. The NCC, and Science Park in general, will be a massive boost to science and engineering in the West, and will work in partnership with companies as well known as GKN Aerospace, Airbus, AgustaWestland, Rolls-Royce, Umeco and Vestas.

The centre will combine business and academic strength to speed progress from research in the laboratory to design, then manufacture and finally into the products that we use every day.

Smoke gets in your eyes



Uma Thurman lights up in *Pulp Fiction*.

Seeing film stars puffing away on the big screen affects young people more than we may think. That's according to a University of Bristol study which shows that young people still associate smoking and Hollywood as 'cool'.

DESPITE MANY FORMS of tobacco advertising being banned in the UK, 'soft' promotion of smoking through films has led to experts recommending age limits for films that glamorise smoking; much in the way there are recommendations for films with violent or sexual content.

The research, which used data from over 5,000 15-year-olds, showed that young people who watch lots of films that include characters who smoke are

73 per cent more likely to have tried a cigarette than those who watched the least number of films. They were also nearly 50 per cent more likely to be a current smoker than those least exposed.

One of the three University of Bristol researchers involved with the study, Dr Waylen, from the School of Oral and Dental Sciences, says: "More than half the films shown in the UK that contain smoking are rated UK15 or below, so children and young teenagers are clearly exposed.

"Our results confirm an association between this exposure and youth smoking in this country, which indicates that raising the certification to 18 in the UK is likely to lower smoking rates among youth."

The study has formed part of an article that was published in the *International Journal of Respiratory Medicine*, which calls for the British Board of Film Classification, the national regulator, to reclassify films depicting smoking. ●

Italian cinema

Leading man

Male roles in Italian cinema are on the rise, says Catherine O'Rawe, from the University's Department of Italian.

THE LAST 10 YEARS or so have seen an extraordinary flourishing of parts for male actors in mainstream Italian cinema, many of them in films set in the turbulent period that followed the upheaval of 1968 in Italy. One of the most successful, 2005's *Romanzo Criminale*, glamorised the activities of the criminal band that it depicts, the real-life Banda della Magliana in Rome in the 1970s. The film also spawned a hugely successful TV series in Italy, which ran for two seasons between 2008-10 and made cult stars of the little-known actors who played the gang.

I look at the reasons for the prevalence of this 'retro masculinity' on Italian

screens, and look at the marginalisation of female characters in these narratives. Like *Romanzo Criminale*, successful films about the 1970s, for example *La Meglio Gioventù* (*The Best of Youth*, 2003), *Mio Fratello è Figlio Unico* (*My Brother is an Only Child*, 2007) and *Il Grande Sogno* (*The Big Dream*, 2009), depict the political struggle, criminality and terrorism that dominated Italian society in the 1970s as a male affair, even as an exercise in male bonding, in a way that I find very intriguing.

By analysing the stars and the performances that are so visible in selling these versions of Italian history to a mainstream audience, I believe we can illuminate some of the reasons that these events still preoccupy Italians today. ●

Right: Scene from *Mio Fratello è Figlio Unico* (*My Brother is an Only Child*, 2007).



LIVING WITH 20TH CENTURY DICTATORS

Professor James Clark from the Graduate School of Arts and Humanities asks:
Is there anything new to say about the dictators?

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THIS IS A QUESTION MANY of us will have asked ourselves when faced with yet another essay on how, when – and why for so long – did one, another, or indeed all of them hold on to power?

Of course, we can talk about the individual personalities involved; in fact there is scarcely any intimate detail now that has not been documented in detail. We can narrate more-or-less every episode in their grim and gruesome progress, and we can cross-check the story with a whole shelf of DVD documentaries, which capture the drama as it unfolds. We can also sketch in the international scene, conscious, in the light of current events, that the politics of Europe have a global dimension.

But how much do we know of what it was like to live under these regimes? How different was daily life under dictatorship? This, of course, was the experience of many Europeans, not only in the build-up to World War II, but also during the Cold War. Some lived their whole lives in this environment. Was ordinary life possible?

Researchers at Bristol are leading a study that aims to uncover their experiences. In part, it is a race against time, as those with first-hand memories of the mid-20th century are now very elderly. Dr Josie McLellan has been interviewing those who experienced the Spanish Civil War and its aftermath, as well as those who endured post-war Communism. Dr Juliana Fürst has been gathering memories of life under Stalin. Dr Tim Cole has been searching in Hungary for memories of the Jewish ghettos and the experience of the Holocaust. It is only since the collapse of the Iron Curtain that it has become possible to do this research and many archives have only recently

been opened. Dr Debbie Pinfold has been scouring the former East Germany in search of evidence of children's lives under Communism. She has even found storybooks for children which reference the Communist regime under the cover of fairytales. This was not simple propaganda, she explains: "Some of these stories are surprisingly critical: one from the 1980s seems to anticipate the 1989 revolutions!"

A picture is emerging of the daily challenges that confronted people, of all ages, as they struggled through the ordinary demands of life under extraordinary restrictions of these regimes. Bristol students are discovering these insights direct from the research front line: these researchers have developed courses based on their work, bringing memories of Spain '36, or the fairy stories of Cold War East Germany into the classroom.

Dr McLellan: "We now have a much better understanding of how dictatorships used leisure and pleasure – from holidays and cars to cigarettes and nude photographs – to win the support of their populations." ●

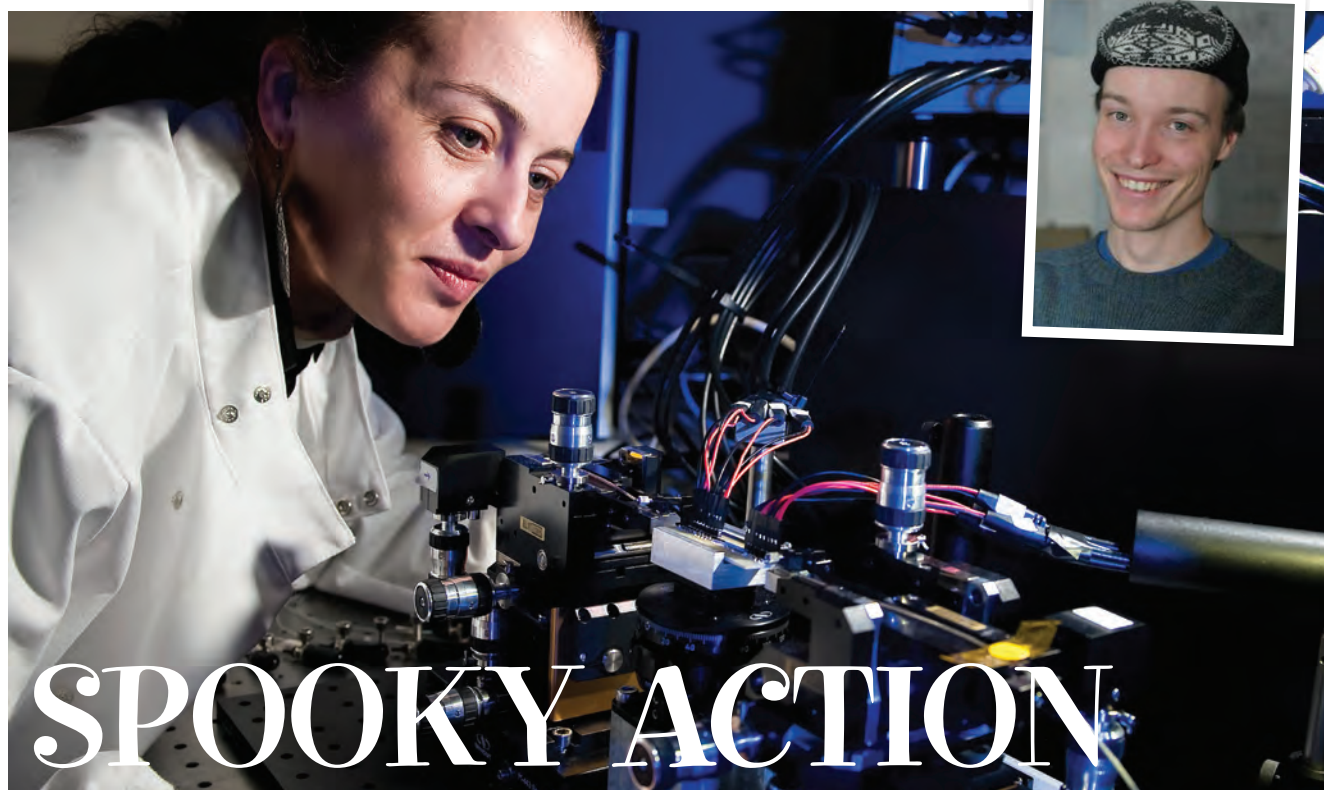
From left:
Spain's Franco,
Germany's
Hitler and
Russia's Stalin.



MORE INFO

www.bristol.ac.uk/history/research/

bristol.ac.uk



SPOOKY ACTION

Physical laws place natural constraints on what is possible, and what is not. It is a remarkable fact that these same laws also restrict the scope of operations that can be performed with information, says **Pete Shadbolt**.

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WHETHER HEWN ON STONE tablets, stored on a memory stick, or encoded in the DNA of a pygmy shrew, information is bound to real physical systems and laws. It is therefore possible to construct information processing tasks which can be solved efficiently within one physical regime, but are effectively impossible – demanding more resources than exist in the known universe, or a computer larger than the sun – in another.

Quantum mechanics is the set of rules which best describe nature at the scale of single atoms and molecules. It is notorious for its counter-intuitive strangeness and “spooky” (Einstein’s quote) behaviour, phenomena which are very far removed from everyday experience and are not accounted for by classical physics. By encoding information in the state of nanoscale objects such as atoms, electrons and photons, these new rules and shortcuts can be exploited for information processing tasks. In principle, this would allow a quantum mechanical machine – a quantum computer – to solve some ‘classically impossible’ problems, such as simulating new chemicals, as well as tackling deep questions in computer science and mathematics.

Researchers from the University of Bristol’s Centre for Quantum Photonics (CQP) are now

working to build such machines, encoding, manipulating and measuring information using the quantum state of single photons – particles of light. Their latest development is a tiny chip, which can be reconfigured to perform several experiments that would each ordinarily be carried out on a bench the size of a dining table.

The chip, which measures 70 millimetres by three millimetres, is made from silica (glass) using commercial semiconductor fabrication techniques, and uses two photons to encode quantum information and generate entanglement, the fundamental resource that gives quantum computers their power. The researchers are now working on scaling up the complexity of such devices, using a greater number of photons and more complicated circuits.

“In order to build a quantum computer, we need not only to be able to control complex phenomena such as entanglement and mixture, but we need to be able to do this on a chip, so that we can scalably duplicate many such miniature circuits – in much the same way as the modern computers we have today,” says Professor Jeremy O’Brien, Director of the CQP. “Our device enables this, and we believe it is a major step forward towards optical quantum computing.” ●

GLOSSARY

Photon:

A single particle of light. The sun emits about 400,000,000,000,000,000,000,000,000,000,000 photons every second.

Quantum photonics:

Historically, experiments in optical quantum computing have been performed using ‘bulk optics’, where sugar-cube sized chunks of glass and crystal are bolted to large benches. Quantum photonics shrinks these circuits onto chips.

Entanglement:

Where quantum particles are intrinsically linked, despite being separated by large distances. Entanglement is the basic resource which gives quantum computers their power.

A life worth living?



Although few of us have direct contact with the animals we eat, the question of whether that animal had a good life is increasingly discussed.

AND IT'S A QUESTION that those working with the Animal Welfare and Behaviour Group are working to answer with techniques developed to assess an animal's emotional state. Many see this type of work as important from an ethical point of view, but results can also inform legislation in areas such as living conditions on the farm and live transportation.

Three members of the Animal Welfare and Behaviour Group, which is part of the University's Veterinary School, outline some of their work into assessing animal welfare.

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HOW DO YOU ASSESS AN ANIMAL'S EMOTIONAL STATE, AND IS IT A DIFFICULT PROCESS?



Professor Mike Mendl:

"It's very challenging. One new approach that we're developing is to train them that one cue, for example a tone of a specific pitch,

predicts something nice such as food, and another cue, a different tone, predicts something less nice such as no food, or a noise. We then ask them – by presenting intermediate tones – 'What do these ambiguous cues predict?' We predict that animals in a positive emotional state, like happy humans, will tend to judge an ambiguous event as being positive, and animals in a negative state with poor welfare tend to judge it negatively.

"This appears to be the case in a number of different species including rats, dogs, sheep and starlings, suggesting that this method may be a useful new way of assessing animal emotions and welfare. However, we can't be sure that animals really feel emotional states in the ways that we might, because we don't yet have ways of directly assessing what they are capable of consciously experiencing."

HOW DOES AN ANIMAL'S RESPONSE TO TESTING HELP WITH RESEARCH?



Professor Christine Nicol:

"Another approach actually 'asks' animals whether they want to be in a cage or not. Obviously you can't ask them with a questionnaire, but you

can give them choices and see how hard they work for particular things. The classic approach is to put the price up gradually. So you might find that a chicken in a cage is willing to 'pay' for more space by putting more effort into pecking a button that makes the cage bigger.

"With animals you assume that what they want matches what they need, so assessing how hard they are prepared to pay for something tells you how much they need it. This kind of work has contributed to the ban on the conventional battery cage, which came into law at the beginning of 2012. Chickens will work very, very hard for a bit more space and also a nest."

HOW ARE ON-FARM STANDARDS CHECKED?

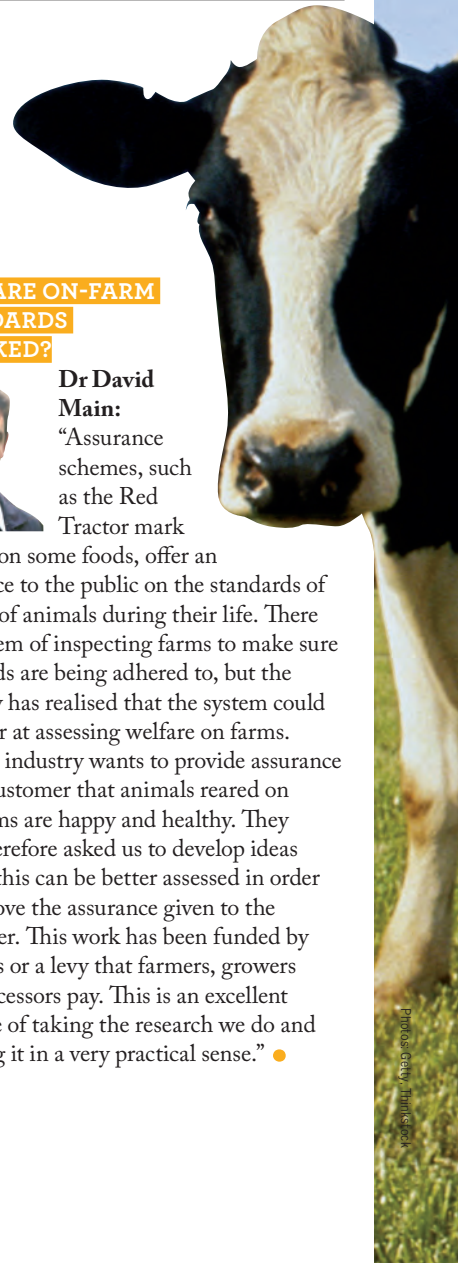


Dr David Main:

"Assurance schemes, such as the Red Tractor mark

you see on some foods, offer an assurance to the public on the standards of welfare of animals during their life. There is a system of inspecting farms to make sure standards are being adhered to, but the industry has realised that the system could be better at assessing welfare on farms.

"The industry wants to provide assurance to the customer that animals reared on UK farms are happy and healthy. They have therefore asked us to develop ideas of how this can be better assessed in order to improve the assurance given to the consumer. This work has been funded by charities or a levy that farmers, growers and processors pay. This is an excellent example of taking the research we do and applying it in a very practical sense." ●



MORE INFO

[www.bristol.ac.uk/vetscience/
research/awb/](http://www.bristol.ac.uk/vetscience/research/awb/)

A MEETING OF MINDS

The Animal Welfare and Behaviour Group is made up of about 70 people. The group is mainly based in the Bristol Veterinary School, but also includes collaborations with vets, immunologists, microbiologists, behavioural ecologists, mathematicians, computer scientists, neuroendocrinologists, psychopharmacologists, social scientists, philosophers, animal welfare scientists, primatologists and epidemiologists, who are based in Bristol as well as other universities around the world.

A woman's place is in the House

Professor Sarah Childs' research within the School of Sociology, Politics and International Studies looks at the changing number of female Members of Parliament over the past 15 years. This research also studies whether these women MPs have made a difference in terms of what is debated and how new laws pass through the legislative chambers.



MORE INFO

The UK's Parliament is currently 49th in world rankings when it comes to equal representation for women and men. In the 2010 general election Labour and Conservative, but not the LibDems, selected more women candidates compared to 2005.

"IN THE PAST 15 years the issue of underrepresentation of women in British politics has been put on the agenda to such an extent that it is now something over which the parties compete," says Professor Childs. "John Major's first cabinet didn't have any women in it, for example, but there's just no way there could be a

womanless cabinet from now on."

When 120 women were elected to the House of Commons in 1997, it seemed that Labour's policy of having all-woman shortlists (that is, only women could stand for that seat), had finally made a substantial inroad into the male dominated status quo. But at the 2010 election, 13 years after 'Blair's babes', only 22 per cent of MPs were

women, just a four per cent increase on that record year.

"The 2010 general election should have been a critical one for women. All the main parties were competing for women's votes and over 'women's issues', and their leaders were all publicly committed to increasing women's parliamentary representation. But it was a missed opportunity. The coalition negotiations that followed the Conservatives failing to win a majority of the vote witnessed all male teams of Conservative and LibDem MPs determining the future government of the UK." ●

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funding the arts

Encouraging a creative spark

With the largest creative sector in Europe, relative to national income, the UK certainly has plenty to be proud of. The Department for Culture, Media and Sport estimates that a million and a half people – or just over five per cent of the UK's labour force – are directly or indirectly employed in the creative industries. And, with these industries accounting for over 10 per cent of the UK's exports, it's clear that people outside the UK are impressed with our creativity.

BUT EVEN WITH an enviable pedigree in everything from music to fashion, film making to computer games, funding for the arts sector, including investment through young people and research at the nation's universities, has taken a knock in recent years.

The study of the many creative subjects that fall under the heading of arts and

humanities remains as important as ever when it comes to the transferable skills that these subjects offer. These include, among many others, critical analysis, independent and intercultural thinking, self-management, presentation of arguments and teamwork, many of the personal attributes employers are looking for in a knowledge-based and increasingly globalised economy such as the UK's.

In these tough times, the arts and humanities are increasingly opening up to the public, so as to remind us all of their importance not just to our economic health and social development, but also to our day-to-day lives and cultural identities.

Bristol is a city well known for its creative output, with about 9,000 of the population employed in the creative industries. Household names include the multiple Oscar-

winning Aardman Animation, the BBC's Natural History Unit, the Bristol Old Vic and the graphic artist Banksy.

In 2011, the city's contribution to the arts included InsideArts, which celebrated some of the exceptional work done by both staff and students at the University.

Dr Bradley Stephens from the University's School of Modern Languages, who led the organisation of the festival, said: "The week was abuzz with a wide range of events – all free and all open to the public. There were many examples of the diverse and outstanding work of the Faculty of Arts on offer.

"Students were central to the momentum of this festival, channelling their enthusiasm for their subjects and activities at every stage, and having the chance to get involved in public engagement first-hand." ●



PHILOSOPHY, IT SEEMS to me, has two distinctive features: the questions it asks and the way it goes about searching for answers. Let's begin with the questions. In one sense, they are the intellectual leftovers; the questions that nobody else takes the time to ask; the questions to which people assume an answer in order to go about the rest of their business.

A scientist uses a particular methodology in order to design her experiment, carry it out, and interpret the data she collects from it. The philosopher asks whether that methodology really justifies the conclusions she draws. Another scientist may accept a theory that is stated almost entirely using a mathematical formalism or using novel and alien concepts. The philosopher seeks an interpretation of this formalism and these concepts; he tries to understand what exactly the theory says about the way the world is.

A musicologist analyses a symphony. The philosopher asks exactly what a symphony is: does it exist over and above its particular performances, recordings and printed scores? And are there objective facts about the relative merits of Bach's Goldberg Variations and Beethoven's Symphony No. 9 that the critic may seek to unearth? If there are, how do we unearth them?

People typically believe the world is the way it is independently of how they or anyone else think about it; they think that the objects they take themselves to see and touch really exist and would have whatever properties they have whether or not they believed they did. They perhaps don't even notice that this is an assumption; they may never have formulated it explicitly and may never have entertained the possibility that it is false. The philosopher does all of this: she formulates the assumption, considers alternatives, and asks whether people have good reason to favour these assumptions.

So philosophy is a subject that searches in the gaps left by other intellectual pursuits. It is concerned with the assumptions that we typically make in order to get started in other subjects or in our daily lives. What, then, about the way in which it seeks answers to these questions? This is a difficult question and one to which philosophers have only recently awoken. The problem is this: If it is philosophy's job to question the methodologies of other subjects and other pursuits, it cannot use any of those methodologies itself. So what methodology does philosophy use?

Some respond to this challenge by denying that philosophy questions all methodologies: there is a scientific

WHAT IS PHILOSOPHY?

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Since he began studying philosophy, **Dr Richard Pettigrew** hasn't felt comfortable answering the inevitable question: What exactly do philosophers do? This is particularly embarrassing since the question is itself philosophical. Recently, however, an answer occurred to him – this is it.

methodology, these philosophers claim, which is beyond question; it is this that philosophy should adopt. This position is called naturalism. On the other hand, there are those that see a distinctive methodology for philosophy: there are modes of a priori reasoning, these philosophers claim, that are beyond question and yet are strong enough to support interesting answers to philosophical questions. One might call this position rationalism.

Until recently, these different methodologies were simply assumed by different philosophers as they sought answers to the questions that exercised them. But today the very question of which is the correct methodology for philosophy has itself become a philosophical question. Thus, the questions of philosophy are not simply the leftovers of other intellectual pursuits; they are sometimes the leftovers of earlier philosophical pursuits. ●

Keep on moving



The link between health and the lifestyle of young people today has been well documented in the media. The decrease in activities that used to be the norm – such as playing in the street – are having a big effect on children and how healthy they're likely to be in later life.

THE PEACH PROJECT is run through the University's Centre of Exercise, Nutrition and Health Sciences, and stands for Personal and Environmental Associations with Children's Health. The project looks at children's physical activity and their eating habits to help researchers understand how active young people are and what keeps them healthy.

Researchers are working with pupils from across Bristol, measuring their physical activity patterns to find out when they are most and least active and, importantly, where they are during these times.

Data gathered from 1,300 primary school children in Bristol showed that children who are allowed to go to places without an adult and who



spend more time outdoors are more physically active than children who don't do these things.

PEACH has also investigated other health issues in young people. One report found that watching TV or playing computer games for more than two hours a day can lead to psychological difficulties.

More recently, the PEACH Project has been awarded further funding by the World Cancer Research Fund, which will allow for further investigation into mid-adolescence. ●

HOW DID THEY TAKE PART?

Participating children wore two small activity monitors around their waist for one week. They also filled in two questionnaires, had their height, weight and waists measured, and gave six saliva samples.

This is the only project that is combining objective measures of location outdoors (using personal GPS receivers) and physical activity (measured with accelerometers), working with children who are moving from primary to secondary school.

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pop equations

The hit predictor

Research carried out at Bristol's Intelligent Systems Laboratory has discovered that it's possible to break songs down into winning components.

SURELY A HIT is simply that – a hit? Not according to the research team led by Dr Tijl De Bie. They looked at the official UK top 40 singles over the past 50 years, with the aim of differentiating songs that reached the top five in the chart from less successful ones.

The research looked at a number of features, including tempo, song duration and the simplicity of chord sequences. The team selected a list of 23 of these features, and subsequently deployed methods from Artificial Intelligence (AI) to devise a 'hit potential equation', able to score any song according to its audio features. They then found they could use the score reached using the equation to classify a song a 'hit'

or 'not hit', up to an accuracy of 60 per cent, predicting whether the song reached the top five, or got no higher than 30.

Building on previous research, the equation was also able to account for evolving musical tastes, through the use of the 'time-shifting ridge regression' algorithm.

"Hit potential is a time-varying concept – today's hit could be tomorrow's flop," says Dr De Bie. "To account for this we used AI methods that are able to track the changing notion of a hit, and thus the resulting hit potential equation varies

Lady Gaga knows what it takes to write a hit song.



over time as well. After launching our website many artists expressed an interest in scoring their songs with our equation, so we went one step further and developed a free online app. Of course hit potential depends on various other factors unrelated to the audio, and thus the equation's accuracy is unavoidably limited. However, we do hope that it may give aspiring musicians some early feedback on their songs." ●

MORE INFO
www.scoreahit.com



Above: Students getting to grips with modern dentistry techniques.

KEEP BRITAIN SMILING

Have you ever wondered how dental students practise before they're 'let loose' on the general public? This is one of the many questions that go through the minds of people of a slightly nervous disposition when it comes to trips to the dentist.

23

IF YOU'RE ONE OF the aforementioned people, you'll be pleased to know that modern day teaching techniques give students an extremely lifelike platform on which to learn their craft.

Dr David Dymock, Senior Lecturer in Oral Microbiology at the University's School of Oral and Dental Sciences: "Students gain excellent hands-on simulation training in our clinical skills lab, including patient simulators used in year one physiology teaching, and use of 'phantom heads' with teeth, set up so students can practise techniques in restorative dentistry skills. Additionally, they learn communication skills through contact with trained actors, so they are prepared for various scenarios and interaction with patients."

This rehearsal in 'bedside manner' will be particularly useful with the University's use in the near future of a 20 dental chair clinic at the almost completed South Bristol Community Hospital. The new hospital is part of a massive investment in this part of

the city, which also includes a new skills academy and leisure complex.

"Students will treat patients coming in off the street," says Dr Louise Nash, Clinical Lead – Community Based Teaching. "We anticipate there will be a large need and demand for free dental treatment from patients with a lot of tooth rot. South Bristol will also allow for greater opportunities for teamwork between dental students and oral hygienists and therapists."

"Working in challenging environments enables students to develop communication skills with people from all social and educational backgrounds. This helps students realise that priorities in health care and well-being differ in different communities. Learning about health issues such as diet, smoking and alcohol consumption also gives students the chance to inform and possibly change behaviour." ●

MORE INFO

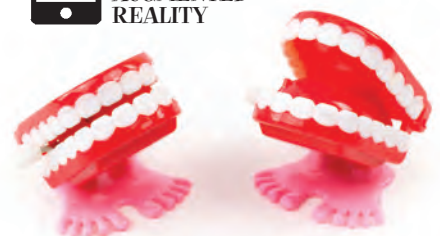
www.bristol.ac.uk/cetl/aims/hps/movies/

PRACTICE MAKES PERFECT

Students spend two terms, one at the end of year two followed by a second term at the beginning of year three, acquiring basic restorative dentistry skills in a superbly equipped laboratory, including use of 'phantom (model) heads' with appropriate technical support. Students revisit this facility in the second term of year four for another course on advanced restorative dentistry skills.



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