

#02 Autumn 2012

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this issue

**HUNTING THE
HIGGS BOSON**

TEEN VIOLENCE

**WHY GIRAFFES
HAVE HIGH BLOOD
PRESSURE**

DISCOVERING
CHINA'S PAST



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AUGMENTED
REALITY

“One of the biggest challenges is sifting through the trillions of collisions”

Bristol physicists outline their involvement in finding the Higgs boson, page 6.

welcome

Welcome to the second issue of Discover More, the University of Bristol's magazine for sixth form students. Following the last issue's introduction to augmented reality, those of you with a smartphone or tablet can follow the app download steps below to find out more about the magazine, starting with the image above...

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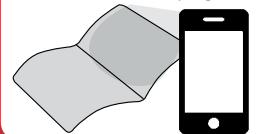
David Alder
Director of Communications

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Look out for the **smartphone logo** through the magazine

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Total wipeout
A graphic representation of a particle collision at the Large Hadron Collider at CERN, Geneva. The two red lines are two muons, the mass of orange lines are tracks from other particles produced in the collision, whose energy is measured in the electromagnetic calorimeter (red cuboids) and the hadron calorimeter (blue cuboids).

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SCIENCE AS STREET ART

BRISTOL'S ANNUAL SEE NO EVIL street art event (above) is the largest of its kind in the UK. Knowing how important the spray can is to the city's recent history, it's perhaps no surprise that students from the University were involved.

Over one weekend in August – and then for as long as the art survives – postgraduate students have been sharing ideas in engineering, nanoscience and chemistry with the public.

Contemporary artist Dan Petley, aka Old Master, helped the 10 University students translate science and engineering concepts into street art.

One of the artists, postgraduate research engineer Natasha Watson, said: "Science and engineering have a bad reputation for excluding the public, whereas this kind of art can be seen by everyone. I hope to get our message out there, showing these subjects can be fun and accessible."

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DISCOVER MORE... ON FACEBOOK!

Why not get involved with Discover More, by taking a look at our Facebook page? Simply search for 'Discover More magazine', and you'll be able to keep up with all the news and events.

One story you'll be able to read about through our Facebook page is a remarkable scientific mission to Antarctica. This autumn, a 12-man team of British scientists, led by Professor Martin Siegert from the University of Bristol, will collect samples of water and sediment from an ancient lake beneath three kilometres of ice.

The mission has taken 16 years to plan, with the scientists working in temperatures of minus 25°C and wind speeds averaging 25 knots!



DR WHO'S TOOLKIT

In a case of life imitating fiction, scientists at Bristol are moving tiny objects in a way previously only realised by the BBC's space-travelling Doctor. 'Acoustic tweezers' use radiation force fields – sound waves – to move things like clusters of cells.

While the magnitude of these forces is small, it's more than enough to move a red blood cell through a viscous fluid in a fraction of a second, and without damaging it. These tweezers show promise in medicine, where they could separate out and sort diseased cells as part of tests.



Above: Researchers suspend tiny balls in sound waves.

Turning a blind eye

A DEVICE THAT tracks eye movement helped researchers from Bristol identify how young people look at cigarette packets. The evidence showed that students who had never smoked were more likely to read the health warnings on both plain and branded cigarette packets. Daily smokers tended to avoid looking at the health warnings on either type of packet.

In what seems to back up claims that plain packets will reduce the number of people taking up smoking, students who were occasional smokers, or who had tried smoking at least once, paid more attention to the health warnings on plain packs than they did to the warnings on branded packs.

Professor Marcus Munafo, one of the report's authors, said: "People tend to start smoking between 13 and 17; if people don't see strong branding in shops this may change their behaviour. Australia has recently moved to plain-packaging, and other countries may follow suit."



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Crowds

IT'S LIKELY THAT SPORTS fans turning up at Olympic venues this summer were blissfully unaware their every move was being scrutinised. But experts in crowd movement had long been micro-managing the effect the arrival of many thousands of people would have on east London.

Dr Anders Johansson, Senior Lecturer in Systems Engineering at the Faculty of Engineering, has spent the past decade studying how mass gatherings can be undertaken in a safe manner. Events such as the Notting Hill Carnival and the Hajj pilgrimage to Mecca in Saudi Arabia pose unique challenges for organisers.

"Crowd modelling has had a direct effect on how these events work," says Dr Johansson. "For

example, in response to problems with crowd behaviour at the Notting Hill Carnival in the early 2000s, the police suggested a few alternative routes the procession could take, and crowd modelling was used to demonstrate that some of these would actually make the situation worse due to increased bottlenecks. Similar types of crowd modelling and analytics tools have been used to make the pilgrimage to Mecca safer."

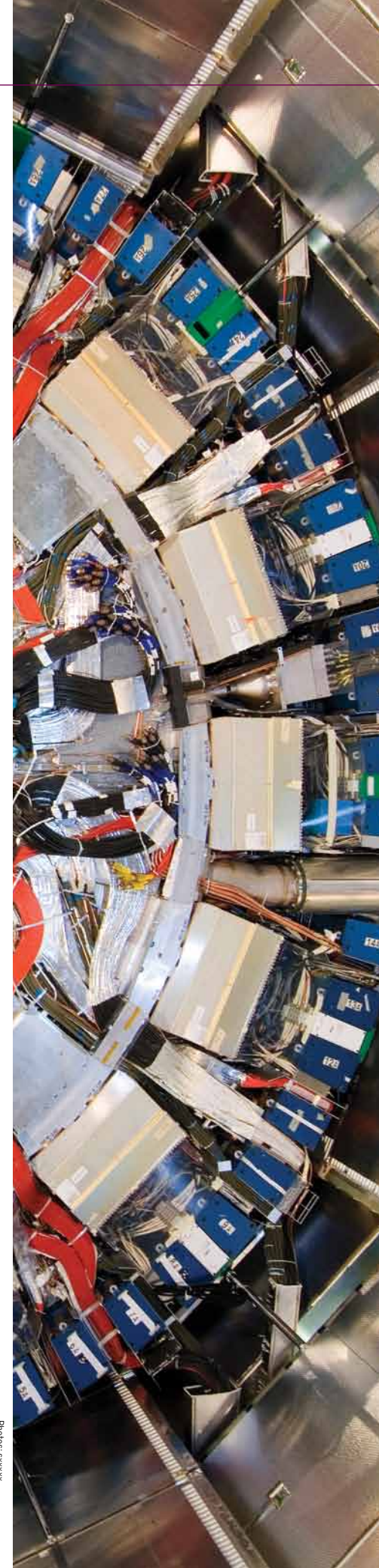
Safety in numbers?
The world's greatest gatherings

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Hunting the Higgs boson

Eye spy
As high as three-storey houses, the massive barrels and end caps from the ATLAS and CMS particle detector experiments at CERN allowed physicists to track down the elusive Higgs boson particle.



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HIGGS BOSON IN 100 SECONDS

Dr Helen Heath was asked by the Institute of Physics to explain the Higgs boson in 100 seconds. To see how she got on, simply download the free 'Discover More AR' app, then hold your smartphone or tablet above her photo...



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THE SMALLEST SHOW ON EARTH

The possible discovery of the Higgs boson 'God particle' in July made headlines worldwide, partly thanks to a team of physicists from Bristol. Two members of the team explain...



DR JOEL GOLDSTEIN, Reader in Physics: In July, we heard the news from Geneva that we'd long been waiting for: the discovery of a new particle by scientists at the European Organization for Nuclear Research, or CERN as it's more commonly known. Two experiments – ATLAS and CMS – examine the head-on collision of ultra-high energy protons in the Large Hadron Collider (LHC). Both experiments are huge, in terms of physical size, complexity and the number of people involved. Bristol is one of about 180 universities collaborating on the CMS experiment, which is basically a gigantic digital camera. It weighs about 14,000 tonnes, has the equivalent of about 100 megapixels and takes pictures of 40 million particle collisions a second. The Bristol team is only a small fraction of the collaboration (about 20 out of 4,000 people in total), but we have played key roles in several areas that were crucial to the discovery.



DR HELEN HEATH, Reader in Teaching and Learning, School of Physics: I've been involved with CMS since I returned to work after my second break for maternity leave. My second child has just taken her AS levels. Over those 17 years I've been involved with the design, testing and construction of the CMS electromagnetic calorimeter. This device is designed to measure the energies of electrons (and their antiparticles positrons) and photons very precisely. Basically the calorimeter is constructed of crystals of lead tungstate, which produce light when charged particles pass through it. The light is collected and converted to an electrical signal, which is dependent on the energy. Each crystal is about the size of the box a tube of toothpaste comes in and there are about 80,000 of them in the detector.

JG: The Higgs boson can show up in various different ways in CMS, but the 'smoking gun' that really makes it possible to claim the discovery is the observation of an excess of collisions producing two high-energy photons, or gamma rays. Detecting this particular signature amongst the trillions of LHC collisions requires very accurate measurement of the energy of gamma rays. Without the electromagnetic calorimeter and Helen's work, this would not be possible.

One of the biggest challenges is just sorting through

the results of the trillions of collisions to pick out those that are the most interesting. It is not even possible to store all of the data that CMS produces – about four PetaBytes (ie four million Gigabytes) every second – so some of this has to be done in real time by the 'Trigger' system. Bristol developed part of the first stage of the trigger. It throws away the data from 99.8 per cent of the collisions, and it only has a few millionths of a second to decide about each one.

HH: Throwing away most of the data might seem to be a bad idea. Collisions at the LHC are governed by quantum mechanics and it's not possible to set up the experiment to produce one type of event. New processes and particles are relatively rare – otherwise they would have been observed before – and only occur in a small fraction of collisions. So, to make more rare particles, your only option is to make more collisions, which also means producing more uninteresting events.

As an example of how we might go about the difficult process of triggering consider a new massive particle produced in a proton-proton collision. This will probably decay rather quicker than much lighter particles, converting most of its mass into the kinetic energy of the particles. So one simple trigger selection might be one or two very high-energy particles.

JG: Another avenue being explored by members of the Bristol group is how to trigger on nothing. The Higgs boson spontaneously decays (just like radioactive atoms) into other particles, and in order to know whether the particle we have found is really the Higgs boson we need to carefully measure how often it decays into each particular type of particle. Some of these particles are easy to spot, like the high-energy gamma rays discussed earlier, but some cannot be detected directly. In some theories these undetected particles could even be the mysterious 'dark matter', something that we have never seen but that astronomers believe makes up 84 per cent of the matter in the universe. Spotting collisions where a Higgs boson has been produced before turning into dark matter and disappearing is obviously very interesting, but very difficult. This is something that undergraduate students at Bristol have been involved in for their final-year research project – the next generation of physicists are already involved in some of the most important experiments ever undertaken! ●

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7



SEEING IS BELIEVING

Augmented Reality technology promises to transform how we learn and see the world, says Bristol computer scientist Dr Walterio Mayol-Cuevas

Imagine being able to train for a complex job with only a pair of glasses or contact lenses to guide you. What might sound like pure science fiction is almost reality, with several developers already marketing phase one versions of the technology.

Augmented Reality, or AR, adds virtual information – objects, colours or sounds – to real objects. This usually involves a device that overlays graphics or video onto objects in front of us.

AR glasses, for example, would free your hands so AR could be guiding you to complete an assembly task as you are training for a job. Or you could follow a cooking recipe, where AR highlights ingredients and at what time they need to be added.

For the time being, mobile phones are the most obvious device for AR technology, because these have cameras, screens and computing power, all of which are essential. The camera captures the real scene; the

computer generates the AR annotation and makes spatial calculations of where to insert it onto the image, which is then displayed on the screen.

AUGMENTED VALUE

£1.8 BILLION

THE TECHNOLOGY'S PROJECTED WORTH IN 2016

For a convincing AR augmentation – one that looks as if the AR annotations are real – the camera needs to know precisely where it

is relative to the object to be augmented. This is why a good computer is needed, together with algorithms that calculate the spatial relationship of camera and object in 3D. This requires techniques from 3D computer vision, which ultimately is linear algebra, image processing and mathematical frameworks that estimate and correct calculation errors.

In recent years there have been great advances in demonstrating the required accuracy and robustness of algorithms that solve many of these problems. AR requires a lot more research before it becomes truly a robust technology, but we are getting there.

Current uses of AR demonstrate only the most basic capabilities of what the technology can really do. Google and Oakley are each developing display technology that won't need to be held by the user. However, for AR to really catch on, the hardware needs to be very good and cause no eyestrain or other fatigue, which is

Why fat is an academic issue

A nutritious diet needn't cost more than junk food, says Julian Hamilton-Shield, Professor in Diabetes and Metabolic Endocrinology

I LOOK AT OBESITY in a number of ways. As a paediatrician, I recommend treatment for children and young people who are affected by obesity, but as a clinical academic I also study what the consequences of obesity are on the young person, their family and the NHS, and how economic measures such as food pricing have an affect on this.

You could look at it this way – in the long run I'm trying to make less work for myself and other doctors. If you can gain an understanding of what's causing a problem early on, it ought to mean fewer visits to the doctor when a person gets older. For example, there is evidence that being overweight as a child can increase the possibility of developing Type 2 diabetes later in life; so understanding obesity has far-reaching effects.

As a doctor in academia you have time to consider problems and ask questions in a broader way than if you're practicing day to day. As an academic you can go outside of looking after patients and influence the way people's health evolves. You can organise trials that look at

different treatments, things that could affect not only your own patients, but patients around the country and world as well.

Medicine gives you a career that enables you to keep asking these questions. In the example of our latest study we asked what would happen if we could influence people's buying power at the supermarket, trying to break the myth that just because someone is economically disadvantaged, they have no choice but to eat less healthy food.

We were able to show that by switching supermarkets and buying healthier food for the whole family, people would, in the main, be able to save money, eat more healthily and reduce calorie intake. For the very disadvantaged, there was an additional cost but this could be addressed with well-focused state interventions. Patients often put the additional economic burden of healthy eating as a barrier to improved weight. With this study we hope to have demonstrated that this barrier is mainly a perception problem, not a reality. ●

THE BRISTOL GRADUATE AT THE FOREFRONT OF A.R.

The AR technology used in this magazine was created by Bristol-based agency Kudan, which works with clients all over the world to develop AR solutions for apps and websites. Kudan's co-founder Tom Wood gained an MEng in Computer Systems Engineering from Bristol University in 2005, then consulted to pharmaceutical companies, before setting up Kudan in 2010.

"The future of augmented reality lies in applications that tie-in closely with and virtually adapt the user's surroundings," says Tom. "Imagine being able to try new furniture out in your living room before purchasing online, or virtually seeing a new car on your driveway. Our technology already recognises images (such as this magazine) and 3D objects, but soon we will be able to identify and replace the environment around you. You will be able to try out new wallpaper, paintings and flooring, and all from the comfort of your sofa!"

"Google are doing some great research into 'wearable' Augmented Reality (goggles and glasses) for consumer use in the future. The challenge with this always-on technology is how users will react to advertisers infiltrating their day-to-day lives further."

MORE INFO www.kudan.eu



Photo: GOOGLE PROJECT GLASS

still to be seen on forthcoming devices.

As with most technologies it takes time to find killer applications, and AR researchers are still concentrating on basic problems to get better and more robust algorithms and hardware. I would love to see AR used to make people more confident in doing things they have never done before. That could help make people more independent, which could bring great benefits. At the moment we augment our ideas and opinions based on what we read, see or hear – something similar could happen with AR, which has the potential to help us do things better. ●

WHY DID YOU BECOME A DOCTOR?

University staff describe what being a doctor means to them



Professor Andy Levy
Head of Finals Assessments, MB ChB Medicine.

You must be prepared for combinations of financial, physical and emotional hardships throughout your career. The reward is working in a rapidly advancing and highly respected profession, and the great privilege of a job in the NHS, which treats magnificently the universal provision of health care as a human right. Operating with limited resources in a cloud of calculated uncertainty, and serving a population with ever-higher demands, you will never be bored.



Dr Sue Wensley
Year 4 COMP 2 unit lead, MB ChB Medicine.

Every patient is unique and has an individual response to illness making medicine a fascinating career. No two patients are alike. As a physician in medicine for older people each patient presents different perspectives and challenges for which it is a privilege to be allowed to help. The making of a diagnosis by assimilating, weighing and balancing information, and negotiating a treatment plan, is hugely satisfying and this has never dwindled in my 24 years of practice.

China exposed

Professor of History Robert Bickers explains how a project that unearths forgotten photos is helping China rediscover its past



TWELVE YEARS AGO, scanned images of old photographs from China started arriving in my email inbox. They came from relatives of British men who had once served in a police force in Shanghai, who had found out I was preparing a book on the subject. They sent me snapshots and portraits, groups of policemen posing in ranks, and pictures of life on the busy streets of that thriving city, as well as more than a few gory shots of executions, or the aftermath of war and violence. What, I wondered, would next be revealed as I opened an attachment from the daughter or grandson of a Shanghai copper.

Once I had finished the book I started to get interested in this mass of material that kept crashing my mailbox. It was clearly just a small sample of a rich, untapped vein of resources for understanding modern China. Most of what I saw I could not find in libraries or archives, in Britain or especially in China. Revolutions and invasions had damaged China's own records, as well as its built heritage. So we set up a project – Historical Photographs of China – to locate and

“Even the smallest set of photographs contains a priceless gem”

preserve such materials, and to share them through the internet with researchers, teachers and students, and anyone else interested in them.

Over the century after 1842, when China was opened to foreign trade and residents, tens of thousands of British people worked in China as missionaries, policemen, diplomats and a host of other occupations. As cameras were far from commonplace, many of these people bought photographs, but some took their own.

We find families which in the past had family members who lived in or visited China. We then borrow surviving private family photograph albums, digitise them and place them online. We now have over 8,000 images on the website, and we have also organised or contributed to exhibitions in Europe, Hong Kong and, of course, China. We've also published a book and worked with heritage and other groups in China looking for scarce records of the past.

And still, almost daily, new offers of material continue to arrive, and even the smallest set of photographs contains a priceless gem.

The great thing about this project, which seems to be about a distant, exotic place, is that it is firmly rooted with the family history of people living in Britain today.

I often teach a first year seminar course on the 1899-1900 'Boxer uprising', a great popular outburst against Christianity and the foreign presence in north China, which rocked the area and left tens of thousands dead. We look at old documents and newspaper reports, and of course old photographs. The course involves preparation of a source-led project, and recently one of the students took me aback when she asked if she could do a project on her great aunt.

The great aunt had been a 30-year-old missionary, Annie King, born in Chesterfield, who had worked in north China for less than two years before she was killed during the great uprising in July 1900. Sources we had available gave us more information about Annie's life and death, but there were also some letters still preserved in family hands, as well as a photograph.

History can start to seem a bit distant if you have spent time working on the great European dictators or the Tudors; but the past – including China's! – is there in any family. ●

MORE INFO <http://visualisingchina.net/>

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Clockwise from top: Women powering a wooden chain irrigation pump, 1920s. (Main image) Actors dress up as famous characters of the day, Shanghai, c.1925. Studio portrait of four boys in a 'boat', Shanghai, c.1930-40s. Visualising, at a peep show stall, probably Shanghai, c.1905. Matshed theatre, Kowloon, Hong Kong, c.1910-1913. Images from 'Historical Photographs of China' collections.

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Brain storm

Do we all face the prospect of mood swings and memory loss as we get old? Perhaps not, according to research that suggests dementia is a preventable disease

FOR A DISEASE THAT affects one in 14 people over the age of 65, dementia is poorly understood, especially when compared to diseases such as cancer and heart disease.

Alzheimer's Research UK report that almost half a million people in the UK have Alzheimer's disease, at a cost to the economy of more than £23bn, not to mention the human suffering involved. But, despite this, the disease is still poorly understood and funding remains lower than one might expect for a disease that affects so many people.

In some respects, research into dementia was a slow starter. Seth Love, Professor of Neuropathology at the University of Bristol: "It wasn't until the 1950s and 60s that scientists began to realise that the changes in the brains of people with dementia were not an inevitable consequence of ageing: that some people got to 100 without becoming demented, and those who did develop dementia had a disease."

Another problem is access to tissue for research. Studying cancer cells in a tumour is relatively easy, as they can be removed and studied while the patient hopefully makes a recovery. The brain is a far trickier subject, as even when someone donates their brain for research it is unlikely that scientists will be able

to study this for at least 24 hours after death.

Finally, as dementia mainly affects older people, it is not as visible as diseases that may affect younger people. With symptoms taking as long as 20 years to develop, there are often major problems once recognised.

Members of the Dementia Research Group at Bristol University bring molecular, genetic, biochemical and neuropathological approaches to the study of dementia.

Professor Love's research looks at large lumps of protein that kill off brain cells, and the enzymes that attempt to break down the production of this protein.

Dr Pat Kehoe, Reader in Translational Dementia Research, has been studying the relationship between high blood pressure and the development of dementia in later life. Kehoe's research is looking at whether drugs used for high blood pressure may also help delay the onset of dementia.

Both remain optimistic that the research happening within the Dementia Research Group will have a positive effect on a disease that affects so many families.

"We'd certainly be closer to putting out the fire before the flames take hold," says Dr Kehoe. ●



ALZHEIMER'S DISEASE

Alzheimer's disease, the most common form of dementia, equates to a change in the chemistry and structure of the brain, which leads to the death of brain cells.

Alzheimer's results in memory loss, mood changes and problems with communication and reasoning. Scientists think that a combination of factors, including age, genetic inheritance, environment, lifestyle and overall general health are responsible.

Main image: A normal brain. 3D computed tomography (CT) angiogram of a section through the healthy brain of a 30-year-old, showing the cerebral arteries and perforating arteries in the white matter.

THE RISE AND RISE OF DEMENTIA

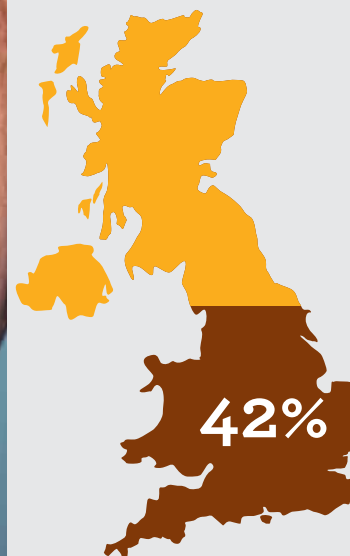
How does dementia affect the UK population?



1 in 3 people aged over 65 will die with a form of dementia

168,000

new cases of dementia occur in England and Wales each year



42 per cent of the UK population know a close friend or family member with dementia



EAST MEETS WEST

Should we be looking beyond the stereotypical images of food queues when we think of the old Eastern Europe? A new Bristol-led project finds out from those who lived behind the 'Iron Curtain'

RESEARCHERS AT the University of Bristol have been finding out what it was like growing up behind what was often referred to as 'the Iron Curtain', meeting and interviewing people who have since moved to Bristol. Claire Hyland and Debbie Pinfold have been finding out how migrants from Eastern Europe to Bristol remember their experiences before 1989. Are they positive or negative? Do their memories focus on the political climate, or everyday life?

"We also wanted to find out how their experiences living in the East before the fall of communism and life in Britain now have shaped their attitudes to the UK," says Claire. "How do they respond to stereotypes about Eastern Europe? Having experienced two very different social and political systems, do they offer a new perspective on Britain?"

The research gives participants the opportunity to have their voices heard, something that is particularly important as the experiences of everyday people from this time are often overlooked. The research also gives people from

different backgrounds the opportunity to discuss their memories of growing up under communism, and will increase the local community's knowledge of the East before the fall of communism in the late 1980s.

Holger Laux, who in 1994 came to the UK from what was previously East Germany, said: "People don't realise that we had pretty normal lives growing up in the East – school, hanging out with other teenagers, holidays and so on. In hindsight, I think I felt quite protected and I still appreciate my good education – I have 13 A-levels! When I first arrived in the UK I was a teaching assistant, the students thought we all wore grey clothes and were miserable all the time!"

"From the information we've collected we're organising school workshops that will encourage critical thinking about multiculturalism, particularly in relation to Eastern Europe," adds Claire. "The workshop materials will also be made available online so that teachers across the UK will be able to use them as teaching resources." ●

MORE INFO
eastmeetswestbristol.wordpress.com

Our colonial past in the dock

Dr Daniel Butt, Lecturer in Political Theory at the University of Bristol, looks at the case for reparations for actions during the days of Empire

BRITAIN'S COLONIAL legacy is currently under scrutiny in the High Court, as a result of a legal action brought by three elderly Kenyans – Jane Muthoni Mara, Paulo Muoka Nzili, and Wambuga Wa Nyinyi – who are seeking compensation for their treatment during the 'Mau Mau uprising' of the 1950s.

The case has already led to concessions from the British government, which has admitted that the claimants were indeed tortured by the colonial administration of the time, and acknowledged the existence of a secret archive of documents relating to the colonial period. The Foreign and Commonwealth Office is opposing the case, claiming that the events in question happened too long ago, meaning that the statute of limitations has expired. Whether this is a good argument in law remains to be seen.

The government's admission of the use of torture in Kenya is just the tip of the iceberg when it comes to the bloody history of the British Empire. Invasion, enslavement, sexual violence, torture, concentration camps and the forcible expropriation of resources loom large in any comprehensive history of Britain's colonial past. As the Kenyan case shows, this is not the exclusive preserve of the far-off 19th century, and yet this history is conspicuously absent from the contemporary public realm.

Of course, the British Empire has plenty of modern day defenders, such as the popular historian Niall Ferguson, who claims that the net

legacy of Empire is positive: "there seems a plausible case that the Empire enhanced global welfare – in other words, was a Good Thing," he writes. Such an overall verdict is much disputed, and there are plenty of historians who would instead point to a lasting legacy of failed states and intercommunity violence. But even if we hold that Britain's past involved both good and bad, are those who have suffered as a result of our actions not entitled to redress regardless?

I think there is a compelling modern day case for reparations to the victims of past colonial wrongdoing. This is not a legal argument of the type currently before the High Court, but instead rests upon a more straightforward moral principle – if some people are suffering from the effects of wrongdoing, then they should be compensated when others are either responsible for, or have benefited from, the injustice in question.

This is a controversial claim when it comes to events that took place some time in the past. We have shown more interest in some parts of our history than others – the Saville Inquiry into the 1972 Bloody Sunday shootings, for example, took 12 years and cost some £400m pounds, leading to an apology and reparative payments from the British government.

I believe we need to show the same seriousness of purpose in relation to all our recent history. An investigation, at least along the lines of the Leveson Inquiry, or better still, in the vein of the Truth and Reconciliation Commission in South Africa following the end of apartheid, accompanied by a throwing open of the colonial archives, would mean confronting many painful truths. But it is the very least the victims of our colonial past deserve. ●



CHILDHOOD MEMORIES

Three people born in Eastern Europe remember growing up before 1989

"During the school holidays we were forced to work for two weeks, or sometimes we would be taken out of school to help harvest potatoes. This helped us to learn a strong work ethic, and sometimes it was really enjoyable." Gita Simanaviciute, Lithuania

"I had a great childhood. I felt protected, my parents didn't have to worry about their jobs and my grandparents were looked after by the state. OK, we didn't have bananas, oranges or Barbie, but I didn't need them to be happy. Where I grew up there was a sense of community and belonging – I really miss this now." Ev Milker, GDR

"State socialism had some good things. The availability of sports and culture was better for people than later. Books, cinemas, theatres and sports events were cheap. The difference in the standard of living between people was smaller than now." Tibor Szabó, Hungary

What goes up

Understanding how the brain controls blood pressure could pave the way to new treatment for high blood pressure – the biggest killer of humans

A GIRAFFE on the African plains has the highest blood pressure of any mammal on earth. Its blood pressure, if measured within its chest, is twice the level of a human's, but when measured at head height is the same as a human's – and for good reason.

This high blood pressure clearly has a purpose – that is, to send blood vertically up several metres to the head. Gravity is doing its best to make the fluid drop back down to earth, but the blood pressure is forcing it up to the animal's head and brain.

While this might work for giraffes, high blood pressure is the biggest killer of humans, with death usually caused by heart failure, heart attacks or renal damage. One in three humans have hypertension, which not only results in people dying, it also puts enormous pressure on health services.

Professor Julian Paton and his team at the University of Bristol are trying to understand why people develop high blood pressure. There are the well-documented causes – not enough exercise, too much salt – but there are also

sufferers who look perfectly fit and healthy. “Classically, people have looked at the kidneys, heart and blood vessels for answers, but we're looking at the brain,” says Julian. “This is because the brain is the most selfish organ in the body, as it always demands exactly what it needs in terms of blood flows, oxygen and nutrients. The brain can redirect blood so that it is sufficiently fed, but this can cause hypertension.”

“We're trying to understand how the brain controls blood pressure. Blood pressure is autonomic, which means that however much you sit there and think ‘I must reduce my blood pressure’, you can have no effect on the level.”

The team have discovered that peripheral chemoreceptors – found outside the skull on the arteries that feed the brain with blood – have a pronounced effect on blood pressure.

A chemoreceptor is about the size of a grain of rice, and has the highest blood flow of any organ in the body per weight of tissue. The chemoreceptors sense oxygen levels in the blood, and screams to the brain to put blood pressure up if they sense a shortage in blood flow of oxygen in the brain's direction.

The brain responds by sending impulses down nerves; these then squeeze up the arteries that most effectively shunt blood away from peripheral organs and towards the brain. But, the consequence is high blood pressure. This has led to Professor Paton's proposed ‘Selfish Brain Hypothesis of Hypertension’.

Professor Paton has successfully removed chemoreceptors, which has led to a way of controlling blood pressure in animal models with high blood pressure. This new knowledge is at the forefront of global research into high blood pressure, and has led to a clinical trial in human patients.

“The research carried out at Bristol could lead to new ways of treating people with high blood pressure who aren't able to take the appropriate drugs – about 15% of those affected – either because they become resistant to them, or the side effects are too awful to tolerate,” continues Julian.

“The projected world population for 2025 would mean that over 1.56 billion people globally would be affected by high blood pressure, making this research more vital than ever before.” ●

BLOOD PRESSURE

Graph showing blood pressure - measured as mean arterial pressure (MAP) - for different mammals.



must
come
down



#happy?

>:] :-) :) :o) :-(- (: (-) :) >:o >:0 :-0 :0 =\ :S

Our love of social media is helping scientists track what we're thinking at any given time, which could have a huge impact on our health and wellbeing in the future

LONDON 2012 showed us how a nation's mood can be altered by an event. All forms of media gushed at the success of Team GB and general glow of good feeling enveloping the country. Even the most hardened anti-Olympics fans seemed to come round by the end of the two-week extravaganza of sport.

But what about trying to measure this mood, rather than just sensing or reading about it? Nello Cristianini, Professor of Artificial Intelligence at the Intelligent Systems Laboratory, has been measuring the nation's mood, and health, by using one of the most commonly used social media – Twitter.

Professor Cristianini: "Twitter encouraged their 200 million users worldwide to make their posts, commonly known as tweets, publicly available as well as tagged with the user's location. This has led to a new wave of experimentation and research using an independent stream of information."

"Between July 2009 and January 2012, almost 500 million tweets were generated by the UK's 9.8 million Twitter users. By logging words users commonly used in tweets, we were able to use these to study the mood and changes of a large sample of the UK population."

By taking into account events at certain times, researchers were able to link the mood on Twitter with the country's general mood. For instance, negative mood indicators coincided with cuts in public spending by the government. Similarly, Twitter users

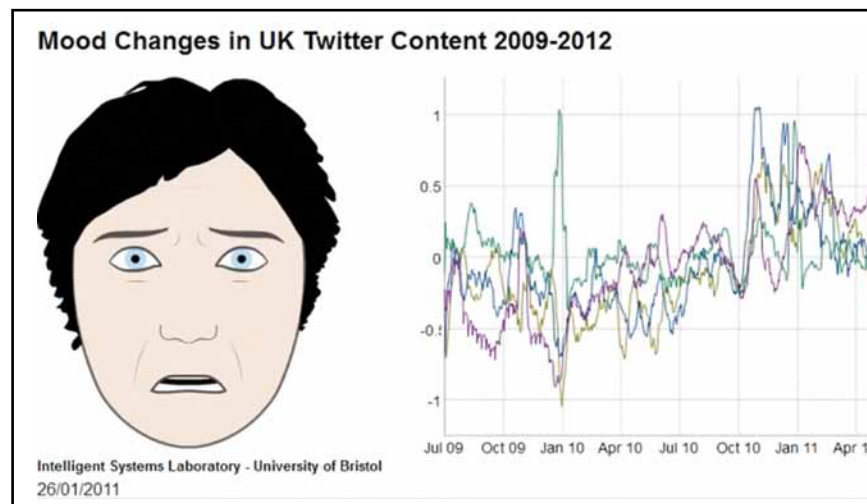
were making their feelings known during the 2011 royal wedding, when the mood shifted markedly upwards. The unrest felt by many of England's cities a few months later was also documented, when there seemed to be a rise in public anger under way in the days before the riots.

Twitter can also be used to measure the nation's health. Professor Cristianini and his team gathered a database of over 50 million geo-located tweets, which were then compared to official data from the National Health Service on flu incidence by region. State-of-the-art machine learning algorithms automatically worked out flu-related keywords in the database of tweets. From this, researchers were able to estimate

incidences of flu in particular areas.

Despite the obvious uses for this technology, Professor Cristianini has reservations about this level of information being in the public domain. "This is a major concern for me. We are changing the world but we do not know what is coming next. Our notion of privacy needs to evolve, but at the same time we need to make sure we are all aware that we are talking about an important value for individual rights. I feel that people are giving up their privacy too readily; we may come to regret that as a society." ●

MORE INFO Twitter moods - <http://mediapatterns.enm.bris.ac.uk/twittermood>



Above: Professor Cristianini logged Twitter users' moods using information gathered from each UK tweet.

Science with a bite

The grisly secrets of dinosaur mealtimes are being revealed by 3D modelling – chomp on this for size...

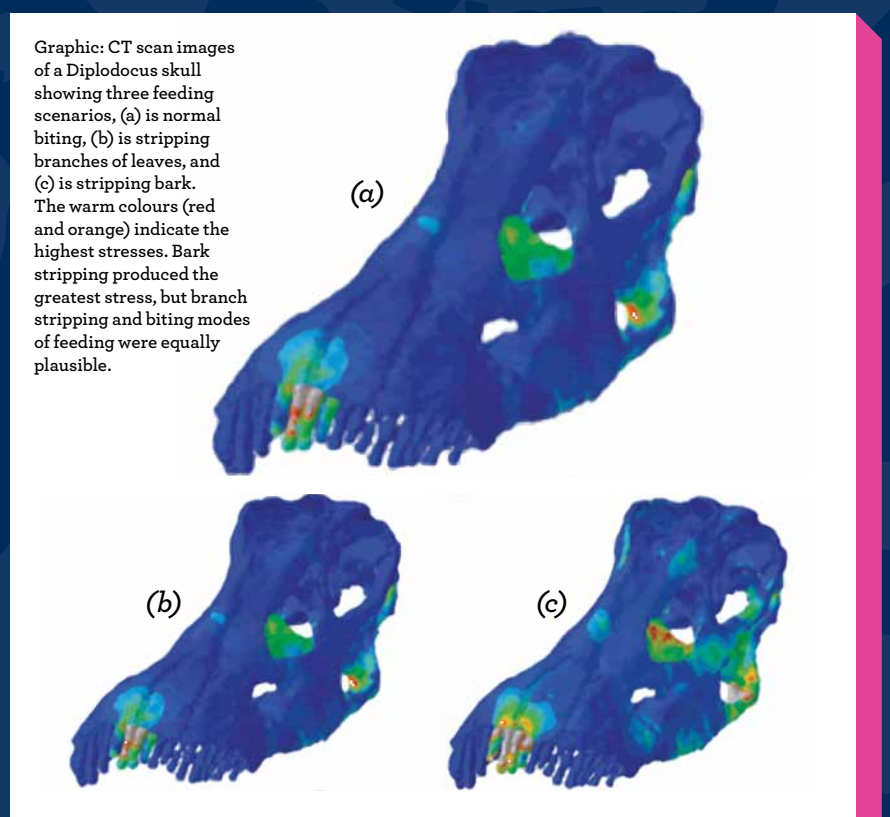
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see page 2

THERE'S LONG BEEN debate over how a Diplodocus, one of the largest animals ever to walk the earth, managed to eat enough to keep itself alive.

In research carried out between the University of Bristol and the Natural History Museum, and led by the University's Dr Emily Rayfield, a 3D model of a complete Diplodocus skull was created using data from a CT scan. The model was then biomechanically analysed to test three feeding behaviours using finite element analysis – an engineering technique that measured the various stresses and strains on the animal's skull while feeding.

Dr Mark Young, a former Bristol student who worked at both institutions, said: "Sauropod dinosaurs, like the Diplodocus, were so weird and different from living animals that there is no animal we can compare them with. This makes understanding their feeding ecology very difficult. That's why biomechanical modelling is so important to our understanding of long-extinct animals." ●

MORE INFO www.bris.ac.uk/science/media/bentonrayfield-video.html



Graphic: CT scan images of a Diplodocus skull showing three feeding scenarios, (a) is normal biting, (b) is stripping branches of leaves, and (c) is stripping bark. The warm colours (red and orange) indicate the highest stresses. Bark stripping produced the greatest stress, but branch stripping and biting modes of feeding were equally plausible.



'NUFF RESPECT?

Teenage relationships are getting more violent, according to worrying research

A SERIES OF NSPCC adverts depicting violence in teen relationships have been shown on TV and cinema screens over the past year. The government, in looking to reduce violence against women and girls, has prioritised this area of public policy, building on research by the University of Bristol's School for Policy Studies and funded by the NSPCC.

The University has been carrying out research into violence between teenagers within a relationship, looking at both young people in education and outside the education system, with some worrying results.

Of those disadvantaged teenagers who aren't in education (for example, excluded from school, young mothers or some children in care), more than half the girls interviewed said they had been involved in a sexually exploitative relationship before they were 18. A similar proportion of girls reported that they had been the victim of physical violence in one of their past relationships. Although rates were lower for girls in mainstream schools, unwanted control and exploitation from boyfriends was also a problem.

David Berridge, Professor of Child and Family Welfare at the University, said: "The high rate

and harmful impact of violence in teenagers' intimate relationships, especially for girls, is appalling. It was shocking to find that exploitation and violence in relationships starts so young. This is a serious issue that must be given higher priority by policy makers and professionals."

Christine Barter, Senior Research Fellow from the School for Policy Studies, said: "Tragically, control and violence seem to be so prevalent in these relationships that girls are unable to recognise its impact – it is an everyday happening."

This research and the government's media campaign have had some success in ensuring the subject of control and violence within teen relationships is a topic that is now discussed at schools and colleges, as part of the wider curriculum. ●



Above: A shot from the NSPCC advert.

The digital family



Is technology good for kids?

Toddlers with iPads, teens losing sleep over games – is technology helping or harming young brains?

"IT'S MEANINGLESS TO SAY technology is either 'good' or 'bad' – it's how, when, why and where you use it, these are the questions that inform the debate," says Dr Paul Howard-Jones, Reader in Neuroscience and Education at the Graduate School of Education.

"Take the iPad for example. States they're marketing tablets at the parents of two-year-olds, on the basis they can give parents a well-deserved break. The plasticity of a child's brain is an issue here as the brain is likely to be impacted at a greater rate at this age, and there's certainly not the research yet to show whether this is a good thing or not. There's definitely a justification for asking

many questions about technology's effect on our brains." A situation that might appear quite strictly managed in family homes up and down the land: teenage children are allowed an hour of technology use before they turn to homework.

"Compared with watching TV, playing computer games just minutes before you do your homework has been shown to affect how much of the homework your brain can actually remember the next day. This is because playing computer games undoubtedly disrupts your sleep more than watching TV. Sleep is needed to consolidate your memory for what happened that day."

But that's not to say it's all bad news. Paul has been using techniques such as neuroimaging to explore why computer

games stand out as a special influence on the brain, and why, in particular, they succeed in focusing the attention of their players so strongly. "Games can also have a positive effect on the brain," continues Paul. "It's a highly engaging activity that can improve visual motor response time for example. Indeed, it's likely that the positive influence that games can have on the brain will change the way children learn in the future – it might be possible to get children hooked on computer games, just as some seem to be hooked on type of immediate reward that users feel when playing computer games could be key to education in the future – children often shriek with delight when they're learning through gaming!" ●

Home grown

Bristol's very own Eden Project can be found nestling in a quiet residential street, just a few miles from the University

THE 1.77-HECTARE Botanic Garden is surely one of the city's best kept secrets. As the first new university botanic garden created in the UK for nearly 40 years, from 2002 the designers were given the opportunity to completely reorganise the way a collection of plants is displayed, with collections including the evolution of plants, local flora and rare native plants.

"The use of DNA sequences in the classification of organisms has completely revolutionised the way we look at plants," says Simon Hiscock, Professor of Botany and Director of the Botanic Garden. "We worked with the garden's designers to create a DNA 'tree', where visitors can see and move through the relationship between families of plants - the first time this has been done in a botanic garden."

"This evolutionary take on the history of plants runs throughout the garden. The Mediterranean collection shows how plants that have evolved in similar climates around the world (including California,

southern Europe, Chile and Western Australia) have developed many of the same characteristics."

The collections house some 4,500 different plant species, including several, such as Bristol rock-creep, that are found within a few miles of the site. The Avon Gorge, which runs for 1.5 miles to the west of the city and is spanned by the world famous Clifton Suspension Bridge, is home to several rare species that have survived in the Gorge's sun-baked niches.



Tree ferns growing in the evolution of land plants display.



The Tropical zone, part of the glasshouse collection

The garden also includes a Useful Plants Collection, which displays plants used in Chinese, Western, Indian and southern African medicine. The Chinese Medicinal Herb Garden includes 180 species, and is the largest collection of traditional Chinese medicine in the UK.

"All our collections are designed to tell a story," concludes Professor Hiscock. "People are fascinated when they learn of the lives of our plants, why they look the way they do and are found where they are. Our plants might be pretty to look at, but that's evolution before your eyes."

PLANTING THE SEED

People of all ages use the garden for educational as well as recreational purposes. Local schools visit the garden to gain understanding of the plants around them, and plant collections are used extensively for undergraduate teaching at the University.

One local connection of particular note is with Writhlington School in Somerset. What started as part of the after-school gardening club 20 years ago has become one of the school's most

successful ventures. With the school's orchids exhibited and sold at horticultural shows, the Writhlington School Orchid Project is now an important part of the curriculum for many schoolchildren.

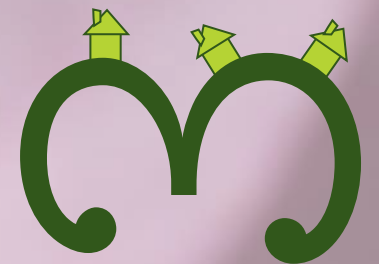
Sales of the plants propagated at the school have been so successful that funds are raised each year to send students to the far-flung corners of the world where orchids grow naturally, places like Brazil, Costa Rica and Sikkim in India.



Botanic Garden staff visit the Writhlington School Orchid Club.

£15

The amount given by Bristol University College in 1882 to set out the first botanic garden



The number of times the Botanic Garden has moved since 1882

4,500

The total number of plant species within the four collections

12,500



The number of plants successfully moved to the new site

DISCOVER MORE