#05 Spring 2014

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discover more

University of BRISTOL

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Details on page 3

this issue

Woman *vs* Ocean

Bristol's Elsa Hammond is aiming to row across the Pacific Ocean... alone

Have your say!

Scan this page to vote on your ideal way to travel to school!

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WET & WILD

Bristol goes downhill

Artist Luke Jerram's latest project attracted almost 100,000 applicants for just 360 places. Park and Slide took place in early May, and gave participants the chance to slide 300 feet down Park Street from the University's Wills Tower.

Find out more at www.lukejerram.com

Image: Luke Jerram

hello!

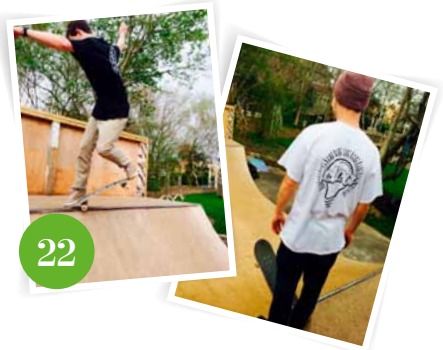
Welcome to the fifth issue of *Discover More*, the University of Bristol's magazine for schools. In this issue we take a look behind the scenes as one of our students prepares to row across the Pacific Ocean and we celebrate 25 years of the University's student newspaper *Epigram*.

Added to this, we get an overview of some of the enterprising projects our students run, and a glimpse into Bristol and the aviation industry.

Finally, you're in with a chance to win an iPad – see page 10 for more. We hope that you enjoy this issue of *Discover More*.

David Alder
Director of Communications

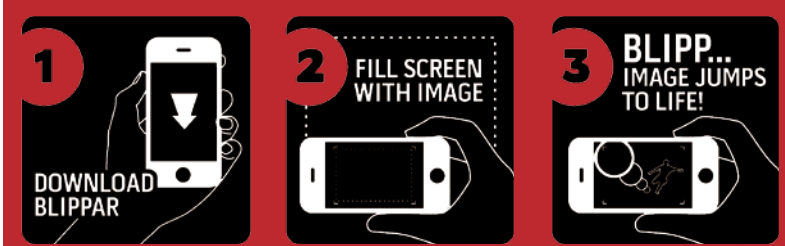
contents



How does Blippar work?

Download the Blippar app from Google Play or the App Store, then use the camera on your phone or tablet to bring the page to life!

Look for this icon for Blippable content throughout the magazine!



This could be a weblink or a video play. Or maybe a competition, a game, a poll... happy Blipping, people!

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Cover image: WillSlaterPhotography.com

Bristol graduate Ben Morris played an important part in bringing *Gravity* to our screens

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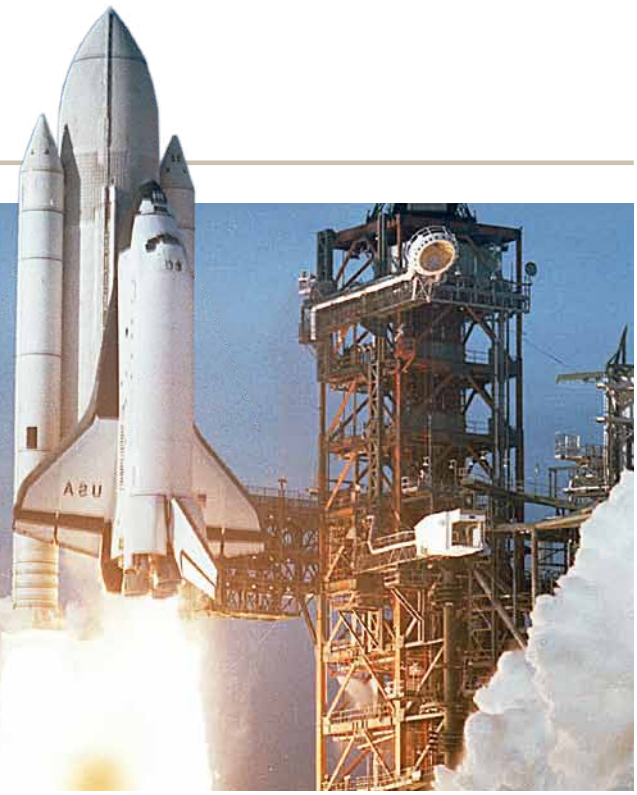
The special effects master

THERE'S A GOOD CHANCE that one of the films you've seen in the past few years had Ben Morris's creativity behind it. Ben knew his future lay in film and animation when he saw *Star Wars* in the 1970s, and, since completing a mechanical engineering degree at the University of Bristol, Ben has worked on several of the *Harry Potter* films, *Charlie and the Chocolate Factory* and *Gladiator*, plus many more.

Now creative director for special effects house Industrial Light & Magic, Ben returned to the University in April to give a talk on visual effects and digital filmmaking to an audience of students and staff.

Ben says that at every stage of his career he has returned to the grounding he received at Bristol. In what must be a dream come true for him, Ben is currently working on the new *Star Wars* film!

Ground control to Major Charles



NASA's top man paid a visit to Bristol to collect an honorary degree earlier this year. Charles Bolden, who was nominated for the post of NASA Administrator by US President Barack Obama, leads NASA teams and manages its resources to advance the agency's missions and goals.

Charles was part of the team that designed and built the Hubble Space Telescope's solar array, when he spent time at British Aerospace in Bristol in 1990. The Hubble telescope was carried into orbit by the Space Shuttle and remains the only telescope that can be serviced by astronauts.

In Mandela's honour

GREAT GEORGE, the University of Bristol's famous bell, rang out for five minutes in December to mark the life of Nelson Mandela, who received an honorary Doctor of Laws from the University in 1996.

The 9.5 tonne bell, reputed to be the finest E-flat bell in Europe and one of the deepest-toned bells in the world, is usually quiet except for University and national celebrations, but the chimes reminded people living within a 12-mile radius of the Wills Memorial Building of the great man's contribution to African and global politics.

Great George's own Twitter page – @GreatGeorgeWMB – is well worth a follow.

The builders of the future

BRISTOL GRADUATES WON THE top two spots in the New Civil Engineer Graduate of the Year awards for 2013. First place went to engineering graduate Joe Smith (left), while Tom Bartley (right), another Bristol engineer, was runner up.

Joe won not only the prize money and international recognition, but also a career-enhancing apprenticeship with the president of the Institute of Civil Engineers. The judges awarded him first prize in recognition of his ability to articulate the challenges civil engineers face, and his work on a number of high-profile projects. Joe joined Arup as a Graduate Geotechnical Engineer after graduating with a first-class master's in engineering.

NUTS ABOUT ENGINEERING

A simple stove designed by Bristol students could revolutionise the way people in Southeast Asia cook and use fuel. The stove is designed to burn candlenuts, a nut that grows in this part of Asia, and can be built from scrap metal such as tin cans using simple tools.

The stove has special air holes that allows for a more efficient burning process, and won the Bristol team this year's Engineers Without Borders Branch Challenge. Teams from the universities of Bristol, Cambridge, Bath and Nottingham had 10 weeks to design something that could help villagers living in East Timor in Southeast Asia.

Two films!
Scan these pages to see Elsa's tour of her boat and rowing on the harbour in Bristol

Blippar download details on page 3

Images: WillSlaterPhotography.com

LIFE ON THE OCEAN WAVES

Getting the adventure bug from children's literature, Elsa Hammond tells Tom Burnett how she is aiming to complete the first rowing race across the Pacific Ocean

"Singing the songs from Les Misérables *might even keep away the sharks!"*

Some adventures just capture the imagination – think Sherpa Tenzing Norgay and Edmund Hillary climbing Mount Everest, or US journalist Paul Salopek, who is currently walking in early humanity's footsteps from Ethiopia, across Asia before heading down the Americas to Argentina.

Add to this list Elsa Hammond, the University of Bristol's very own transglobal explorer. In June, Elsa will join the handful of women who have single-handedly rowed an ocean when she rows from California to Hawaii, a distance of 2,400 miles across the planet's largest expanse of water.

Elsa, who is currently studying for her PhD in English Literature at Bristol, puts some of this adventurous spirit down to her favourite book as a youngster: "We moved around quite a lot when I was younger," says Elsa, "from Denmark to Italy and finally to England, so I got used to spending time with books. My favourite was *Swallows and Amazons*, which really got me interested in adventure."

This has taken many forms, from rowing for her Oxford college to pole vaulting at a national level, unicycling across England to raise money for a conservation trek in Borneo to getting stranded in gale force winds up a mountain in Scotland. But now Elsa is taking her adventurous spirit one step further as she becomes the only European female solo competitor in the inaugural Great Pacific Race, the first rowing race in the Pacific Ocean.

"The custom-built, 24-foot ocean rowing boat is storm-proof and self righting, and has lots of communication and safety equipment," continues Elsa. "The biggest danger is from shipping, these huge container vessels that are criss-crossing the oceans. I've got an ATS transponder that beeps if there's shipping close by, handy if I'm asleep, and I've also got a radar reflector that makes my boat look much bigger than it actually is for ship radars. My role is to make myself known!

"More welcome will be the wildlife I'll see. This will hopefully include whales, dolphins, albatross and flying fish. There may even be sharks. I'll need to get into the water from time to time as the hull needs cleaning – the rule is, if you've seen a fin then you stay out of the water for 24 hours."

Beyond rowing

As well as rowing for up to 16 hours each day, Elsa will also be making water with an electric desalination device, keeping up to date with navigation, making sure she's eating enough calories to sustain this level of effort, and sending regular blogs and audio updates with her allotted five minutes of satellite phone use each day.

"As it's unusual to be in this kind of boat in the middle of the Pacific, I'll also be taking water samples and recording what I see as I row. The route will skirt the edge of the Great Pacific Garbage Patch – a mass of floating plastic estimated to be the size of Texas – so I'm working with the Plastic Oceans Foundation and Adventurers and Scientists for Conservation to further their research."

While the endurance side of the challenge has been foremost in Elsa's mind for many months now, the need to raise funds for the event has pretty much become a full-time job.

"Having to raise such a large amount of money is hard work. I've had to learn about

Left: Elsa's route across the Pacific
Below: Strapped into the storm harness and on the harbour in Bristol

project management, fundraising, web design, adapting presentations for schools and businesses, networking, event management… the list goes on!"

As well as training on the River Avon in and around Bristol, Elsa has taken her boat to Cornwall and Dorset for sea training and has also been capsized in Bristol docks to get used to being in the boat if it turns over.

The challenge awaits

The boat left for the USA in April, and since then Elsa has been training hard to reach her peak rowing condition for when she is reunited with her craft in California in late May.

"The race seems very real to me now. I'm even having dreams about being in the boat, not being prepared! In one dream I had left shore only to discover I only had one sandwich to eat for the three month voyage! But one of the things I'm most looking forward to is being able to sing out loud. I've got the ocean to myself for about 90 days, so I'll be able to sing the songs from *Les Miserables* at the top of my voice without anyone complaining. It might even keep away the sharks!"

Two boys in a boat

Another ocean, another mega challenge

Elsa's story is jaw-droppingly incredible, but she's not the only person from the University of Bristol who is pitting their wits against the globe's vast oceans. Jamie Sparks, who is studying archaeology and anthropology, and his lifelong friend Luke Birch, finished the Talisker Whisky Atlantic Challenge on 27th January.

The pair completed the gruelling challenge in 54 days, during which time they battled huge waves, 30-knot winds and no more than 80 minutes of continuous sleep. They also became the youngest ever pair to row the Atlantic.

Raising money for Breast Cancer Care after Luke's mother was tragically diagnosed with the disease, they boys made over £300,000 to become the charity's biggest ever individual fundraisers.

One of Jamie's blogs, sent while on board their boat 'HMS Maple Leaf', gives a sense of how hard life was for those 54 days: "I can say with total honesty that for the rest of my life I will truly cherish the simple pleasures in life, such as tea, being able to sit down, being able to walk and being still."

Well done lads, a truly amazing success!

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The boys wearing more clothes than they were accustomed to during the race!

Respect the germs

Believe the TV adverts and you'd think every house should be germ free, but bacteria are actually vital to our health, says Alastair Hay, a GP and Professor of Primary Care in the School of Social and Community Medicine

There are thought to be 10 trillion cells in the human body. However, it is thought there are 10 times as many bacteria (one type of germ) as human cells in the body – we are seriously outnumbered!

Bacteria can reproduce up to every 20 minutes, giving them superb adaptability to changes in their environment. Compare that to the positively snail-paced human reproduction. Not only can bacteria pass on their genetic information to subsequent generations every 20 minutes, they can also pass it within generations in gene parcels known as 'plasmids'.

But despite what you may hear on television adverts, we need germs – they help digest our food, they clear up food left on the pavement and they may even help protect us from certain diseases.

What do bacteria like?

Bacteria usually live in harmony with the other residents of planet Earth – it is not in their interest to kill the hosts in which they live. They like warm, moist places and don't need much light, so up noses and at the back of throats are just fine. They like to spread themselves around – so they love young children who happily stick fingers in each other's mouths, noses and other places we shall not name.

What are the main threats to bacteria?

Us! Humans are afraid of germs because (for reasons we don't always understand) they sometimes go mad and make us ill (such as chest and urine infections) – sometimes very ill (such as pneumonia and meningitis). Humans like to exert control, and we use vaccines and antibiotics to help us.

But remember – the bacteria adapt fast, so although antibiotics can reduce the chances of getting some illnesses, the bacteria have a tendency to modify and develop resistance. When they are resistant, the antibiotics no longer work to help get us better.

In fact, every time we take an antibiotic, we increase the chances of our bacteria becoming resistant – in other words, every time we use an antibiotic we use up a little of the antibiotic's effectiveness both for ourselves and people we are in contact with.

For these reasons, I have come to respect the germs and, as a GP, I try to only prescribe antibiotics when I think they are absolutely necessary. I hope you feel the same way!

100 trillion
the number of bacteria in the human body

20 minutes
the time it takes bacteria to reproduce

Antibiotics can reduce the chances of getting some illnesses, but the bacteria have a tendency to modify and develop resistance

READ ALL ABOUT IT!

10

University of Bristol students have been producing their own magazines and newspapers for well over a century, but the current newspaper, *Epigram*, is really blazing a trail in student journalism

Celebrating the 250th edition in 2012 and its 25th anniversary year this March, *Epigram* was the UK's first student newspaper to be printed in colour and the first in Europe to go online. So it's no surprise that past contributors to the newspaper - including *Good Morning Britain* presenter Susanna Reid and the BBC's Deputy Political Editor James Landale - have risen to the top in the media industry.

From humble beginnings with just the one computer between them, the *Epigram* team now totals 62, and every fortnight during term time a run of 5,000 copies hits halls of residence, departments and the students' union.

Josephine Franks is the current editor: "We now have sections including features, comment, culture, music, film and science, all of which have their own editors and regular writers. *Epigram* is an integral part of university life in Bristol and a unique platform for students. Although we evolve with each term, the core values remain the same: to voice students' concerns, to interest and entertain readers and to encourage them to engage in university life.

"There's quite a bit of responsibility that comes with working on the newspaper. I've never done anything quite like it before - it's a really steep learning curve! But we all work with each other to produce something we're really proud of each fortnight. The experience is fantastic."

To celebrate *Epigram*'s silver anniversary, a themed gala ball was held at Bristol City Museum and Art Gallery in early March, the venue that hosted the hugely successful Banksy exhibition in 2009. Guests included the Mayor of Bristol George Ferguson and James Landale, *Epigram*'s first editor.

"To begin with we were only going to have a few drinks but it snowballed into this huge event. It was great fun," concludes Josephine. "Here's to another 25 years of inspirational writers, engaged readers and the power of the student voice!"

Design your own front page and win an iPad!

Feeling inspired after reading our *Epigram* story? Here's a chance to test your photography skills...

Scan these pages (see page 3), add a photo of something interesting happening in your school and email it to **discovermore@bristol.ac.uk**. The best entry will win an iPad, and will also appear in the next issue of *Discover More*. You'll find photography tips on page 19.

HOW DO YOU PUT TOGETHER A STUDENT NEWSPAPER?

1 Editorial meeting: Matt Field, Sol Milne and Anna Fleck discuss the next issue. The team then create a 'flatplan', which outlines which stories will go where in the paper.

2 Getting the story: Editor Josephine Franks gathering information by phone.

3 Face to face: Finding out who has been doing what around the University, taking down accurate notes.

4 Write it up: Putting the information into an article that will interest the reader.

5 Photoshoot: Including original photography on a page can really help bring the newspaper to life.

6 Design and layout: Tori Halman and Matt Field set out the pages to include articles, photos, quotes, and interesting facts and figures.

7 Distribution: Morwenna Scott and Anna Fleck distribute *Epigram* around the University.

Images: WillSlaterPhotography.com

Getting involved with community issues is one of the most rewarding things you can do as a student, plus it looks great on your CV. Bristol's Amy Finnegan tells us about her award-winning experience with a seriously fruity local youth scheme...

Everyone's a winner

Amy Finnegan, above, is in her second year at Bristol, where she is studying maths and economics. She will be completing a sales and trading internship at Morgan Stanley over the summer.

What are the BREAD Youth Project and Juicy Blitz?
BREAD is a Bristol organisation that involves young people in tackling the issues that affect them and others across the city. Juicy Blitz, BREAD's mobile juice bar, is an enterprise led by the young people at BREAD that makes smoothies and wraps to sell at local events.

How did you and the team get involved?
We all individually applied for the Morgan Stanley Community Impact Challenge, and eight of us – Jack Loydall, Laura Yell, Francesca Jones, Doga Makiura, Jonny Maltz, Hugo Plunkett, Rebecca Watson and me – were selected to represent Bristol for the eight-week project. The charities involved put together a brief of the kind of help they were looking for, then each university team was matched to a charity.

Have you done anything like this before?
Most of the team members had some form of charity involvement prior to the project, but the brief really allowed us to take more of a strategic, business-orientated approach to our charity work, which was new for all of us.

What was it like being team captain. What kinds of challenges did you face?
I really enjoyed the experience and learnt a great deal through the process, but there were plenty of challenges along the way. The team were very enthusiastic, and it was easy to get carried away and make plans that weren't realistic in the eight-week time frame. We also had to ensure that the suggestions we were making were realistic for the charity to implement, given their resource constraints.

Tell us about the work you got involved in.
We were asked to outline what a corporate

"We were up against some brilliant teams, so were a little shocked to win!"

Above: The young people behind Juicy Blitz have been busy feeding people all over Bristol from their mobile juice bar

engagement strategy could look like for BREAD. We carried out research into best practice and spoke to businesses about what they were looking for in charities. We also helped to develop the BREAD website, and worked on the business plan for Juicy Blitz.

How do you think BREAD benefited from the team's time?
Time is very precious at BREAD, so we were able to do the research tasks that BREAD wouldn't have had time to do. Our research culminated in a number of suggestions that BREAD are starting to implement, the benefits of which will hopefully soon be seen.

What were the main things you learned?
The learning experience was a very diverse one. Not only did it help to develop my leadership, teamwork and communication skills, it was also an opportunity to learn more about the challenges faced by young people in Lawrence Weston, as well as the difficulties charities face.

What was it like winning the challenge?
The best thing about winning the challenge was knowing that it meant £5,000 to help BREAD deliver their work. We were up against some brilliant teams, so we were very pleased, if a little shocked, to win!

Are you still involved with BREAD?
We are still working closely with BREAD on how to implement our suggestions. The team was made up of people from all years, and the team members who will be in Bristol next year are hoping to continue our work with BREAD.

BREAD Youth Project

"I think this project was beneficial to everyone concerned," says BREAD's Emma Rigby, project leader for the Juicy Blitz mobile juice bar. "The young people who come to the BREAD Youth Project at Lawrence Weston might be the same age as the Bristol students who took part in the challenge but they're from very different backgrounds.

"To give you an example, one of our young people went to university last year, the first time this has happened. But they responded very well to each other as peers, and I think they learned a lot about each other as well."

The Morgan Stanley University Community Impact Challenge

The challenge helps to strengthen links between universities and their local communities. The 2014 Challenge saw competitors from 11 leading UK and Irish universities develop strategies to improve the connection between charities and the corporate world.

Students who take part have the opportunity to develop new skills, get involved in local community issues, make useful contacts and take part in a project that will make a real difference to where they live.

BEATING THE

Teams of schoolchildren have been competing against the Bristol-built supercar in an attempt to become the fastest thing on Earth

All going to plan, at the end of 2016 the Bloodhound SSC will smash the current land speed record to become the first vehicle to break the 1,000 mph barrier. The car is currently under construction near Bristol, and will be driven by Andy Green, holder of the first (and only) supersonic land speed record at an average speed of 763 mph.

The Bloodhound team have chosen Hakskeen Pan, a huge, dried-up lakebed in South Africa, for their attempt. Locals have already begun clearing the 12-mile long, 600 yards wide 'track' of surface stones.

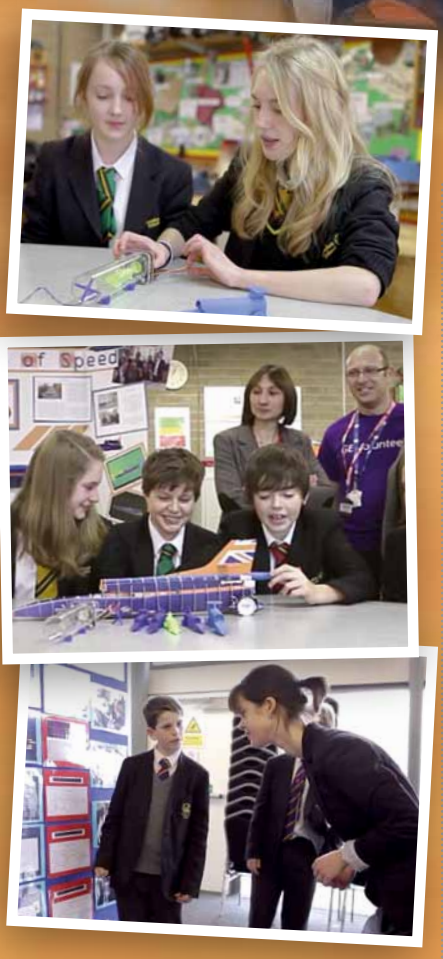
School involvement

One of the most important elements of the project has been the aim to contribute to the rising popularity of science, technology, engineering and mathematics (STEM) subjects, and, so far, over 5,000 secondary schools have incorporated the Bloodhound project into their science classes.

Bringing schools even closer to the action is the SPEED: Beat the Bloodhound project, which gave 200 school pupils the chance to design a virtual car capable of beating the Bloodhound's 1,000 mph target.

SPEED is being led by Bristol-based Zenotech. Company director David Standingford: "What you're looking at is an engineering adventure we're sharing with the world. SPEED is inspired by Bloodhound, and we thought it was a tremendous opportunity to motivate children to learn more about engineering.

"We're making available state-of-the-art, high-performance computing for classrooms, with the challenge that the teams can actually tweak the design of the Bloodhound supersonic car and race against each other and the Bloodhound itself."



Above: The teams gathered to present their findings to the competition judges

To do this, the teams had access to one of the University of Bristol supercomputers, enabling them to use fluid dynamics analysis to try and beat the supercar.

Simon McIntosh-Smith, Senior Lecturer in High Performance Computing and Architectures at the University of Bristol, says: "This was a fantastic opportunity for schoolchildren to use the University's Blue Crystal supercomputer, one of the fastest in the world.

"They competed with their friends and with teams from across the country, trying to come up with the fastest possible Bloodhound car design. They were able to use the power of high performance computing and computer-based simulation, the same kinds of techniques that Formula 1 teams use."

"It's beneficial to the University to have these strong links with schools," says Adele Ruston, Widening Participation and Undergraduate Recruitment Officer at the University. "It gives us the chance to show off the University's facilities and schoolchildren get the chance to see the

THE SCHEDULE

SPRING 2015 Bloodhound will make its first rolling tests at an airfield in England

AUGUST 2015 A series of runs at carefully ascending speeds on the Hakskeen Pan in South Africa

LATE 2015 AND 2016 More fine-tuning back in England

Images: Siemens NX

BLOODHOUND

BLOODHOUND SSC

- Rocket- and jet-powered car designed to travel at 1,000 miles per hour
- 44 feet (12.8 metres) long
- Weighs over seven tonnes
- Generates 135,000 horsepower — the equivalent to 180 Formula 1 cars
- At its fastest, the car is expected to cover nearly 1,500 feet (the length of five football fields) per second
- It will take almost five miles to bring Bloodhound to a halt with airbrakes, parachutes and, at under 200 mph, inboard brakes on its cast-aluminium wheels
- To break the record, the car must complete two legs — outbound, then back over the course in the opposite direction — within 60 minutes

Andy Green: the fastest man on Earth

Photo: Stefan Marjoram

kinds of things our students get involved in and the inspirational teaching they receive."

The devil is in the detail

Each of the 12 teams had one million different design permutations from which to adapt the Bloodhound's shape.

"The teams were able to play with a variety of parameters that affect the geometry and running of the car," continues engineer Dr Ben Evans, "so things like what angle should the car be at, what angle should the nose have, at what time should they launch the rocket. They've been trying to understand what we've been trying to understand: what drives the performance and, ultimately, the top speed of the car."

"I was amazed to see these children – 11- to 14-years-old – talking about quite complex aerodynamic concepts and high performance computing, things that I wouldn't have had a clue about when I was their age. It's amazing to see what the Bloodhound project can bring to a school science lesson."

The fastest design came from the team from St Edward's School in Cheltenham. Their car, designed by Year 7 pupils James Sykes, Luc Dinwiddy and Ben Rodrigues, reached a speed of 1,039.26 mph.

The team from Clevedon Community School won the prize for Best Presentation, as the judges felt they portrayed their team's work in the best way, another very important aspect of the competition, and a skill that engineers have to use on a daily basis.

There are teams from several other countries currently putting together cars to try and break the British-held record, says driver Andy Green. "Britain has held the record for just over 30 years and there's nothing quite like the promise of losing it – or actually losing it – to keep us focused on getting the record back. The record has belonged to someone from this country for longer than every other country put together, since the first record was set in 1898, and we're not going to let it go without a fight!"

HOW DOES THE BLOODHOUND COMPARE?

28 mph

The maximum speed USAIN BOLT reached when he set his 100m record in 2009

833 mph

FELIX BAUMGARTNER jumped from a height of 38,969 metres to reach this speed!

1,050 mph

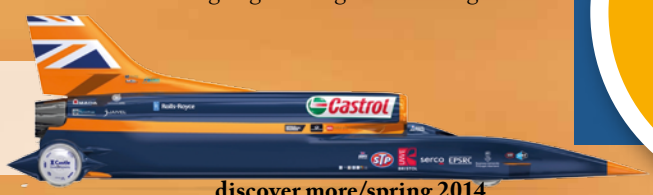
At peak speed the BLOODHOUND SSC will be faster than a bullet from a .357 Magnum

24,790 mph

SATURN V generated 21.6 million thrust horsepower at launch

See how they did it... Scan these pages to watch the **Speed: Beat the Bloodhound** film

Blippar download details on page 3



AUGUST/SEPTEMBER 2016 Bloodhound's assault on the 1,000 mph target

From atoms to aircraft

BRISTOL & FLIGHT

Aircraft production began in Filton, north Bristol, in 1910

The Bristol Aeroplane Company factory in Filton was the largest in Europe by the start of World War II

Concorde (left) was designed and assembled in Bristol and France

The Airbus A380 super jumbo, the world's largest commercial aircraft, was developed and part built in Bristol

Bristol has been hugely important in the history of flight, and Professor of Aerospace Materials Hua-Xin Peng describes how this is still the case

Today, flying has become almost as routine as catching a bus. This has much to do with the development of materials that enable the industry to make lighter and stronger aircraft components. The Airbus A380, part of which is built in Bristol, and the Boeing 787 have made air travel not only more comfortable, but also greener and more affordable.

Local knowledge

The University's Advanced Composites Centre for Innovation and Science and the Bristol-based National Composites Centre are at the forefront of this new technology.

Scientists are working on the development of so-called 'black aluminium', or carbon fibre reinforced polymer (CFRP) composites. When compared to the aluminium alloys still much favoured by the aerospace industry, CFRP is lighter and many times stronger.

This is largely down to the fact that carbon atoms have been persuaded to arrange themselves in a particular form for the production of such aircraft composites.

If you arrange the carbon atoms in a row, you essentially form the backbone of the polymers, which forms the polymer matrix of a carbon fibre reinforced polymer composite. Arrange carbon atoms in a single layer sheet and you have 'graphene', a one-atom thick layer of graphite.

We can produce carbon fibres that are effectively made up of sheets of graphene. These carbon fibres are used to produce aircraft components such as the composite wing box, a vital component that links the two wings of an aircraft. The latest Airbus A380 is made up of about 25% composites, while the soon-to-be-launched A350 will be more than 50% composites.

Work to be done

The aerospace industry faces a number of challenges in incorporating more of these materials into aviation products. One such issue is that engineers are given very little warning when these materials are about to break – when it fails, it goes quickly. Scientists need to develop what are known as 'non-destructive testing techniques' in order to see how such damage occurs.

But compare today's progress with that 12-second flight in 1903, and then try to imagine where we will be in another 100 years. ●

FROM SMALL BEGINNINGS

Man's first flight – Wright brothers, USA
Time: 12 seconds in 1903
Distance: 120 feet
Speed: 6.8 mph

Voyager 1 – interstellar space
Time: 36 years so far...
Distance: 12 billion miles from Earth
Speed: 40,000 mph

Images: Getty, Thinkstock, Science Photo Library

Down on the farm

Have your say!
Scan this page to tell us: where do you stand on animal welfare?
Blippar download details on page 3

The last 50 years have brought a revolution in the science and politics of animal welfare. Professor David Main describes how the Bristol Animal Welfare and Behaviour group has been at the forefront of this change

McDonald's are using free-range eggs as a result of consumer pressure

The welfare standards of farm animals first became a major political priority after publication of *Animal Machines*, an exposé of intensive agriculture by Ruth Harrison in 1964 that resulted in funding for animal welfare science to find better systems.

This included work led by the University's Professor Christine Nicol that showed the welfare benefits of larger cages for laying hens, which eventually led to the ban of the old-style barren battery cage across Europe.

There is, however, a limit to the opportunities for such radical change, and there are unlikely to be further major changes in husbandry systems driven by legislation. But, despite this, we are entering into a new era of welfare improvement in which, again, the University of Bristol team have been actively involved.

People power

Now, rather than legislation, it is the consumer and industry that are driving improvements in animal welfare. In the wake of food crises such as mad cow disease and more recently 'horsegate', the industry is very keen to maintain high animal welfare standards.

Cages before and after the change in regulations on chicken housing

Most livestock products sold by the major retailers are now assessed by the Red Tractor scheme, and Bristol research has resulted in a more animal-focused assessment system on the vast majority of UK pig and dairy farms.

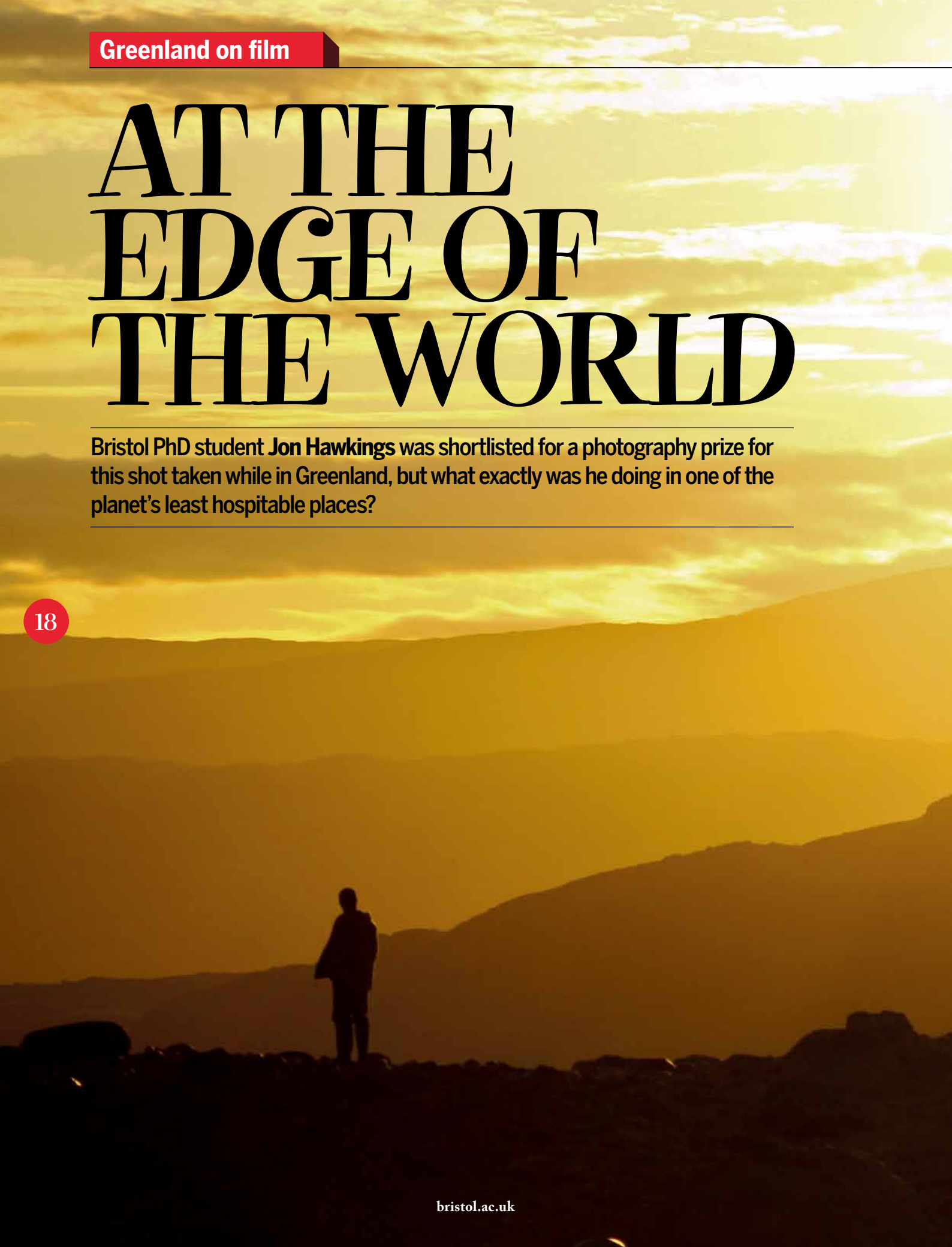
The dairy industry is also keen to deal with animal welfare issues, such as lameness, that although not often raised by consumers are nevertheless a major problem for animals. At Bristol, we have demonstrated that with relatively minor tweaks in the management of animals, farmers can achieve much lower levels of lameness. The dairy industry has incorporated this advice into national campaigns.

Increasingly consumers have also shown that they want higher welfare products. The consumer power has had surprising effects, with even McDonald's in the UK requiring all free-range eggs and RSPCA Freedom Food certified pork products.

Researchers at Bristol are at the forefront of helping to define and demonstrate the benefits of these higher welfare systems, which can only be of benefit for animal welfare in the future. ●

AT THE EDGE OF THE WORLD

Bristol PhD student **Jon Hawkings** was shortlisted for a photography prize for this shot taken while in Greenland, but what exactly was he doing in one of the planet's least hospitable places?



From the beginning of May to the middle of August last year I was part of a team that set up a remote field camp adjacent to a large meltwater river exiting Leverett Glacier, a catchment glacier of the Greenland Ice Sheet.

Leverett Glacier extends nearly 90km into the ice sheet interior and covers an area over 600km^2. We reached camp by off-roading in a 4x4, by crossing a river on a pulley boat, and then trekking over tundra, while our equipment was flown in by helicopter.

During the summer in Greenland the concept of time is lost. As most of Greenland is above the Arctic Circle, the sun doesn't really set during June, and when the weather is clear nature puts on a dramatic show.

This photo was taken around midnight, just after we had finished working for the day. Pictured is another scientist in our field team, Ben Linhoff from Woods Hole Oceanographic Institution in the USA, admiring the views across the once glaciated valley that leads towards the nearest settlement of Kangerlussuaq, around 30km away.

The aim of my PhD is to evaluate how important ice sheets may be in global nutrient cycles, by studying the chemistry of melt water runoff. Melting ice sheets are thought to have a significant impact on oceanic ecosystems in the polar oceans. I'm particularly interested in nutrients that feed oceanic phytoplankton – the plants of the ocean – such as nitrogen and phosphorus.

Phytoplankton is at the bottom of the food chain – they're primary producers, creating energy by photosynthesis. In fact they are responsible for around 50% of the primary production on Earth. They not only provide the energy source for the rest of the oceanic ecosystem – from krill to whales – but they 'eat' the greenhouse gas carbon dioxide.

An average day at the office?

Not many people are lucky enough to call a remote Greenlandic glacier their home and office for two months – drinks taste pretty good with a couple of 10,000-year-old ice cubes in them! And instead of the mundane commute to work, you pass musk ox, reindeer, arctic hare and banks of wild flowers, while the pristine, dominating, Greenland Ice Sheet provides the backdrop.

It's not easy, but the challenge is compelling and rewarding. Importantly, you get to experience what very few can while discovering something completely new.

Once my PhD finishes I hope to continue in research. I particularly enjoy working in Arctic environments, despite the often harsh conditions, and I'd like to continue studying the importance of ice sheets to global biogeochemical systems. ●

"Drinks taste pretty good with 10,000-year-old ice cubes in them!"

SNAP HAPPY

What does it take to capture that perfect shot? Here are Jon's tips for success with a camera:

1 The rule of thirds
Divide your image up into nine equal parts by equally spacing horizontal and vertical lines (some camera viewfinders have this built in). Important aspects of your photo, for example mountains, should be placed along the lines.

2 Shoot at dawn or dusk
Makes for great looking photos, the colours really pop out and you get more interesting light. Shooting at midday tends to wash out photos.

3 Have a reference point
This provides the images with something to convey the size of the landscape, for example a person. This will also give the photo a focal point, and more personality.

4 Use a tripod
You want to keep your camera as still as possible, especially in low light conditions. I love Gorilla Pods as they're portable and rugged.

5 Get creative
Digital photography means you can afford to shoot at will – experiment!

The art of networking

How complicated is the development of a nervous system? Using a computer-generated tadpole brain, Professor Alan Roberts and Dr Steve Soffe in Biological Sciences found that forming connections may be simpler than we thought

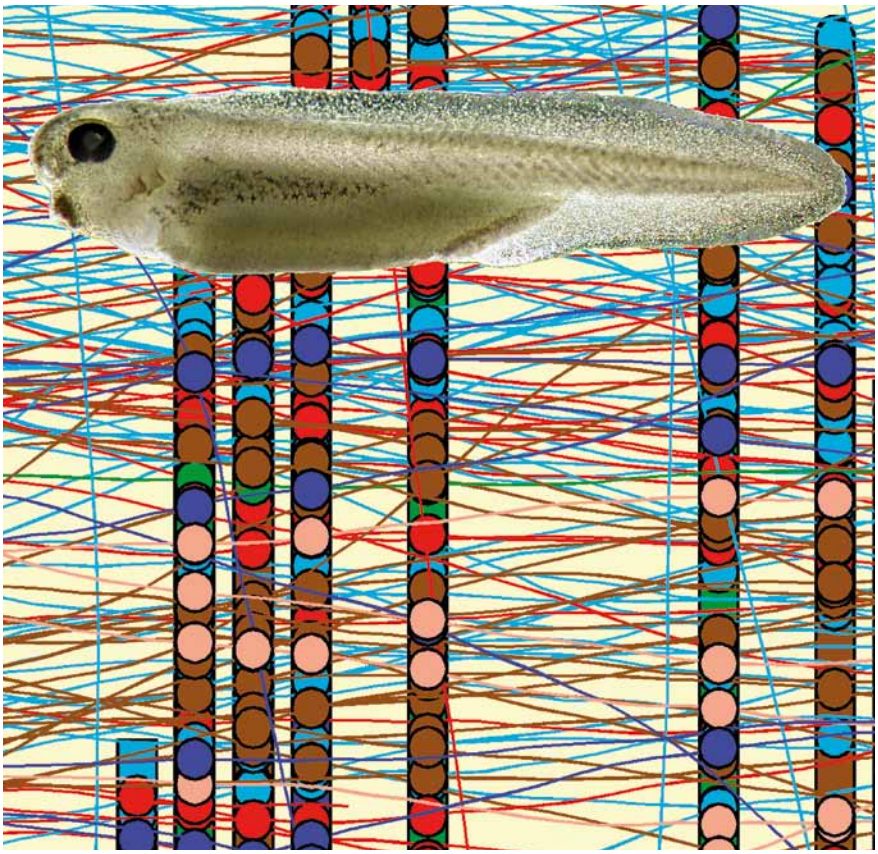
When nervous systems develop, nerve cells grow out nerve fibres, or 'axons', to make connections called synapses. Some of these connections are remarkably accurate. For example: motor nerve cells in the spinal cord connect to the correct muscle in your hand, and ganglion cells in the retina grow axons to make a map of the visual world in the brain.

You might expect all nerve cells to use complex recognition mechanisms to find the targets they like, but our recent study suggests otherwise. We're researching whether a working nervous system may develop using much simpler mechanisms to build a 'crudely' connected network. If this is the case, it might be possible to build a computer model showing how nerve cells grow and simple brain networks develop.

To do this, we studied how newly hatched tadpoles swim when touched. Previous studies show that touch-activated swimming behaviour is controlled by a network with seven types of nerve. This work defined the nerve cells, their properties, activity, connections and anatomy.

To build their model network the team 'opened up' the tube-like tadpole brain and laid it flat. The resulting long narrow growth field was given barriers to channel axon growth and three chemical gradients to steer growth direction. The seven types of nerve cell were then distributed along the model nervous system and simple equations steered axon growth so it matched real axons in tadpoles. Axons can stay on one side of the nervous system or cross to the opposite side, then grow towards the head or the tail. As they grow, axons contact the branches of other nerve cells by chance. They then make connections with a probability of 40% to 60% based on experimental evidence.

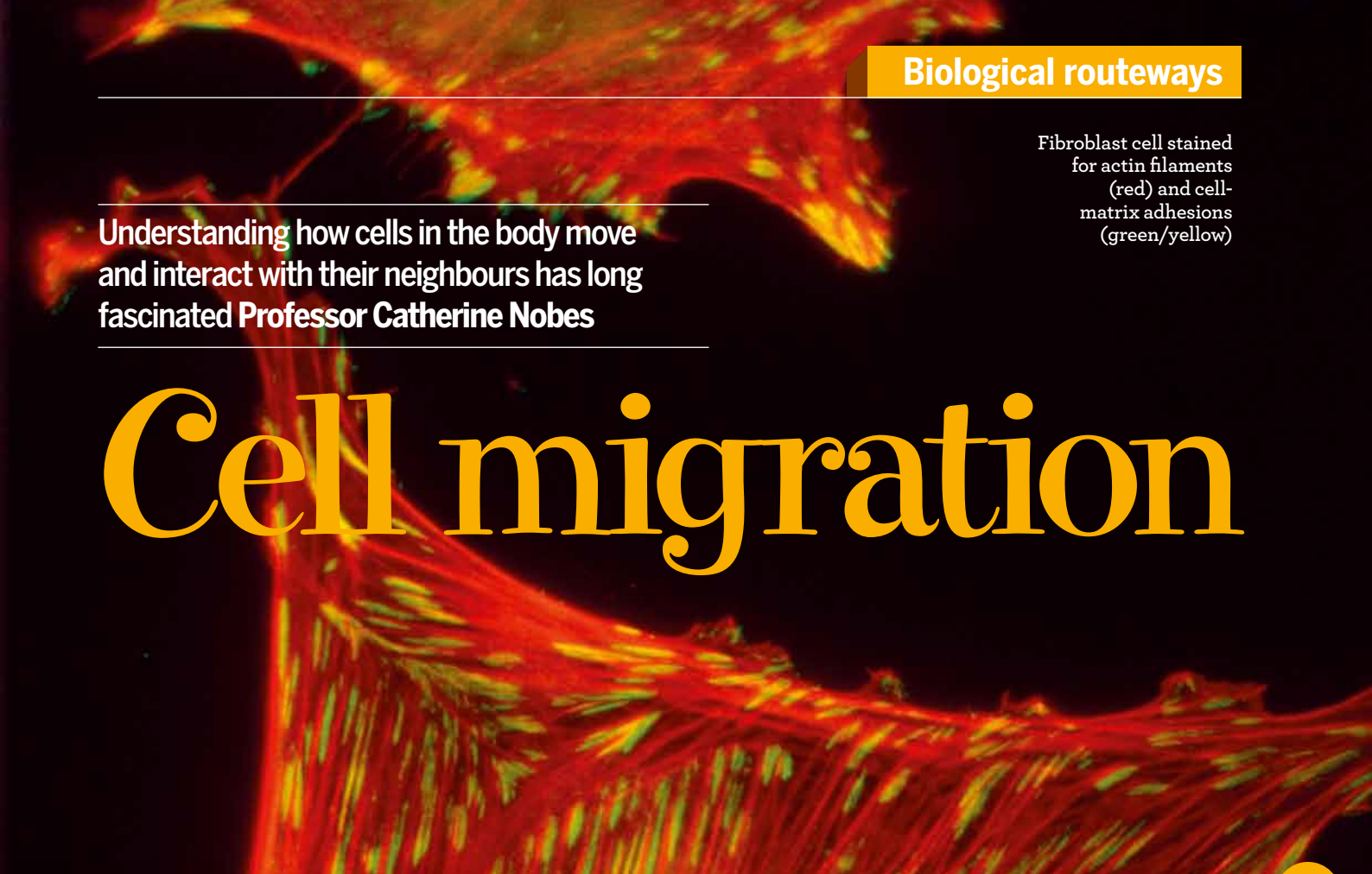
The hatchling clawed-toad tadpole and a fragment of the computer-generated tadpole swimming 'brain', with 1,300 nerve cells making almost 90,000 connections



The resulting computer-generated tadpole swimming network, with 1,300 nerve cells making nearly 90,000 synaptic connections, shared many properties with the real adpole. In response to simulated touch it produced a coordinated rhythmic pattern of activity that in life would generate swimming.

In conclusion: there is more than one way to form the brain's detailed neuronal connections. Basic networks, like the tadpole swimming network, might form using simple rules, but more complex connections, like the eye map in the brain, will require subtle molecular recognition mechanisms. ●

Find out more at www.bristol.ac.uk/biology/research/behaviour/xenopus/



Fibroblast cell stained for actin filaments (red) and cell-matrix adhesions (green/yellow)

Understanding how cells in the body move and interact with their neighbours has long fascinated Professor Catherine Nobes

Cell migration

Cell migration is fundamental for our biology. In the embryo, individual cell movements and mass cell migration events are key for building our tissues. Then, in adult tissues, migration of cells such as immune cells and skin epithelial cells is essential for healing damaged and infected tissues. However, cell migration is not always for the good. For example, during cancer progression, inappropriate cancer cell migration leads to cancer spread. The way in which cells crawl around the body and how they behave when they contact other cells in their path is key to all these processes.

My research, over many years, has explored the signals that regulate how cells move and how molecular conversations between cells, when they contact one another, affect their migratory behaviour. We are currently focusing on how cancer cells spread, and by understanding these mechanisms we might help in future healthcare.

Why is this research field captivating to me? I love watching timelapse videos of cells as they move around and collide with one another in the tissue culture dish. Crawling cells move by pushing out their cell membrane at the front and pulling up their back end at the rear. These pushing and pulling movements involve a key cellular cytoskeletal protein called actin that assembles in an end-to-end fashion to form filaments. Growth of actin filaments is favoured from one end (the + end) and growing ends are positioned just beneath the cell membrane. Actin polymerisation therefore pushes against the cell membrane, causing it to protrude at the front. At the opposite end of the cell, contraction of bundles of actin filaments, called stress fibres, is important for retraction of the cell's rear end, so it keeps pace with the protruding front end.

So how do the fibroblasts behave when they collide with one another? Normally, collisions between migrating cells triggers a repulsive response between them with both cells halting their forward migration and switching their back end to a front end in order to move away from one another.

"By focusing on how cancer cells spread, we might help in future healthcare"

But not all cells behave in such a polite way. By contrast, the migration of many cancer cells is not restricted by contact with non-cancer cells. Some cancer cells ignore or overcome the repulsive cues between cells that restrict cell movement. So if we could reinforce the normal contact inhibition rules to the cancer cells we might be able to dampen down cancer spread. ●

THE PROVING GROUND

Got a great idea for a business? The funding, advice and desk space available at Bristol helped get these budding entrepreneurs started

The number of lively minds you encounter every day at university makes it an ideal place for testing out a bright idea. And many within the university fraternity – students and academics alike – are on the lookout for a business opportunity. As these budding entrepreneurs show, the University of Bristol is no different.

ULTRAHAPTICS

Name: Tom Carter
Studying: Computer science PhD
Business: Ultrahaptics

Ultrahaptics could take us to the next level when it comes to interacting with technology. Based on the use of ultrasound to displace air, the user will be able to 'feel' the controls of computer games, car radios or computer screens in mid air.

Tom and Professor Sriram Subamanian last year beat 75 entries to win the top prize in Bristol University's New Enterprise Competition. The team won £15,000, plus support and business advice from the Bristol SETsquared Centre – the University's business incubator.

"[Student start-up scheme] Basecamp was fantastic at providing advice and support in the early stages of starting my business," says Tom. "I was an undergraduate student when I had the idea to start a company based on technology that I had been working on for a research project. I was able to sit down and talk it through with Basecamp and form a plan of how to progress the technology into a state that could be commercialised.

"Ultrahaptics is now based in SETsquared but I still regularly talk to the entrepreneurs in residence. No matter how many experienced mentors you have, the input from another recent graduate who is running their own business is still very valuable."

IDEA SKATEBOARDS

Name: Rob Owen
Studying: Zoology and psychology degree
Business: Idea skateboards

"My dad taught me to make skateboards when I was younger, so I've been making boards for myself and friends for a few years. Since last October, I've been taking the business more seriously, including going to China to source boards and working with designers to get their ideas onto boards and T-shirts.

"Help from the University has been invaluable – I just wish I'd gone to them for advice earlier! You can get one-to-one help, visiting experts to work with, the chance to go to workshops and seed funding to help get your idea off the ground.

"Any artists, illustrators or designers who would like to design a skateboard, please contact us at **ideaskateboards@hotmail.com**."

SEXEDMEDS

Name: Gethin Lewis
Studying: Medicine, graduates this summer
Business: SexEdMeds

"SexEdMeds came from the desire to improve access to high quality, up-to-date sex information for young people and teachers, following modern graphic design principles. The idea came about in my third year at medical school. I wanted to develop a company to form a well-recognised brand, and in doing so provide a launch pad for future products.

"We got office space, one-to-one mentoring and business advice opportunities from Basecamp, the University's team of entrepreneurial students and graduates, all of which have made a big difference to how we've worked as a company."

PEDAL POWER

Name: Sam Harris
Position: Entrepreneur in residence, Basecamp
Business: Pedal Power Transport

Sam graduated last summer with a degree in biology, and has been a business advisor for aspiring student entrepreneurs at Basecamp ever since.

"I set up Pedal Power in 2011 for three reasons – I like bikes and exercising, to reduce fossil fuel use and congestion in Bristol, and to increase the number of fun jobs available," says Sam. "We deliver cargo, including the University's Epigram newspaper, we also do wholesale food and catering, print and film industry work, and have a luxury pedicab for weddings, marketing campaigns and so on.

"Basecamp gave me a summer office space and a grant of £1,500. As the business grew I went on to win the New Enterprise Competition award with a grant of £7,000 to expand the business. Basecamp has also been very useful in providing mentorship and guidance, and now a job!"

University of BRISTOL

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