

# IMPERIAL

THE MAGAZINE FOR THE IMPERIAL COMMUNITY / WINTER 2024/25

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**SCIENCE  
FOR  
HUMANITY**

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# IMPERIAL

THE MAGAZINE FOR THE IMPERIAL COMMUNITY / WINTER 2024/25



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## YBM



# DIGEST

## SUSTAINABILITY

### The future of food

Centre for Sustainable Protein launches at Imperial with US\$30m funding.

From fungi to fermentation, two new centres at Imperial are radically rethinking how we produce and consume food. The new Bezos Centre for Sustainable Protein, funded with a US\$30 million donation from the Bezos Earth Fund, will use engineering biology and AI to develop new, affordable, environmentally friendly ways to get protein into our diets.

And Imperial has co-launched the new National Alternative Protein Innovation Centre (NAPIC), with support from the UKRI Biotechnology and Biological Sciences Research Council, Innovate UK and more than 100 UK and international stakeholders.

Animal-based protein products such as meat and eggs need vast amounts of land and produce significant greenhouse gas emissions. And more needs to be done to transform plant-based proteins into healthy and palatable food. The NAPIC will work on ways to make these new proteins mainstream in the UK, from product design to consumer acceptance.

“Food security is one of the biggest challenges facing humanity,” says Imperial’s President Professor Hugh Brady. “For a sustainable future, we need to ensure that people across the world can be fed adequately and nutritiously with minimal impact on biodiversity, climate and our wider natural environment.” ♦

## IMPERIAL STRATEGY

### Science for Humanity: this is how we shape the future

**Imperial’s new strategy**, Science for Humanity, will “maximise Imperial’s potential as a force for good” and shape the direction of the university over the next 10 years. Building on consultation with staff, students, alumni and the local community, the strategy sets out, in concrete terms, how Imperial’s work will deliver for people at a local, national and global level.

Science for Humanity builds on extraordinary work taking place at Imperial right now in: human and artificial intelligence; health and technology; climate, energy and sustainability; and space and security – all of which you can read about in *Imperial* magazine!

> *Get into the details of how the strategy will guide Imperial’s direction on page 12 and keep an eye on the Imperial site for more in-depth analysis at [imperial.ac.uk/magazine](https://imperial.ac.uk/magazine)*

### Join the Imperial LinkedIn community

Looking for a way to stay connected with the Imperial community while building your network? On LinkedIn you can connect with more than 450,000 members, stay in touch with the alumni relations team, keep abreast of everything that’s happening on campus and join the conversation on everything Imperial.

It’s also the perfect platform to share your thoughts about latest topics covered in *Imperial* magazine, as Alan Rose did recently in response to a feature on STOIC

(Issue 56). “Ah, the days of running after the Secretary of State for Education with 23kg of UMATIC video recorder on your back and a camera in your hand,” he wrote. And ET Tan remembers his “knees trembling” standing in front of the camera in the STOIC studios. “It was my first time doing a public speaking class... and there were only three of us there!”

> *Join the conversation on this and all other topics at [linkedin.com/groups/87488](https://linkedin.com/groups/87488)*

The new strategy maximises Imperial’s potential as a force for good, providing a road map for the next decade



**On the cover**  
Crystals of the light sensitive protein “Cl-rsEGFP2”.

### CONTACT US

We love hearing your updates and stories, so please do keep them coming. Please mark your message ‘For publication’. Messages may be edited for length.

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 in [linkedin.com/groups/87488](https://linkedin.com/groups/87488)

FROM THE PRESIDENT / PROFESSOR HUGH BRADY

## At Imperial, we believe in the power of science to shape a better future for humanity.



**Our vision for the future matters for industry, for our global partnerships, for our alumni community and for society as a whole**

**S**ince the launch of our new strategy, Science for Humanity, at the start of 2024, we have been building and enabling plans to deliver our vision – some of which you may have seen in the news, in newsletters from Imperial or perhaps have even been involved with. Science for Humanity is our vision for the future but it's not just here, within the walls of our campuses, that it matters. It matters for industry, for our global partnerships, for our alumni community and for society as a whole – which will benefit from the groundbreaking discoveries, innovative startups and technological solutions.

As a member of our alumni community, or as a supporter of our work, you know more than most that what is learnt here on campus is about more than our tremendous strength in science, technology, engineering, medicine and business (STEMB). Every day, our students, staff and partners come together to interrogate the forces that shape our world. Every faculty and department is applying scientific principles of curiosity, rigour, humility and bravery to enable scientific discovery, innovation and entrepreneurship. We are interrogating the biggest challenges facing humanity in global health, climate change, AI, business leadership and more.

In this issue of *Imperial*, I'm excited to share with you more about why Science for Humanity is so important – to Imperial and to the world. And to share with you additional details about our plans for the future.

These include the launch of our Imperial Global strategic initiative, with hubs in Singapore, USA, Ghana and India. With Singapore launching earlier this year, the USA and Ghana this autumn and India early next year, these new hubs will enable us to build talent and innovation bridges across the globe, creating platforms for academics, industry partners, entrepreneurs and students to set up new networks. We are looking forward to strengthening our academic and industrial partnerships through our new hubs as well as having the opportunity to support our growing alumni network.

There will be many opportunities for our alumni communities around the world to engage and support our strategy throughout the years ahead, through: our Institute of Extended Learning, which will offer flexible and high-end advanced STEMB continuous professional development and executive education; and our four new Schools of Convergence Science, that build on our disciplinary strengths and interdisciplinary culture to create deeply integrated research communities at unprecedented scale. Our new Imperial Inspires Scholarship Programme will also transform our ability to support underrepresented groups, in the UK and abroad, to enter into and excel in our STEMB degree programmes.

Through *Imperial* and our new-look website, we will continue to keep you updated with our latest news and how you can get involved. ♦

> *Professor Hugh Brady is President of Imperial College London.*

PHOTOGRAPHY: IMPERIAL COLLEGE LONDON/THOMAS ANGUS

IMPERIAL GLOBAL

### Launch of Imperial Global USA

Imperial is coming to America – and its new San Francisco hub in the Bay Area, which opened in October, will bring a host of opportunities for stateside-based alumni to get involved and engaged.

Of course, Imperial has longstanding connections with California: current collaborations include academics from Imperial, Stanford and the University of California, San Francisco developing radical AI-enabled tech for healthcare and science. But the Imperial Global USA hub makes it even easier for innovators to partner on both sides of the Atlantic.

And this can create huge benefits for society, says Science Minister Lord Vallance. “This is a great example of how pairing the UK’s genuinely world-class university research sector with innovators, investors and entrepreneurs abroad will help turn cutting-edge research into innovative new businesses, and drive economic growth for the UK, the US and the world.”

**This will help turn cutting-edge research into innovative new businesses, and drive economic growth for the UK, the US and the world**

HEALTH AND WELLBEING

### Mohn Centre launches

Young people took centre stage as the new Mohn Centre for Children’s Health and Wellbeing was launched in October. The Centre hosted talks and panels to highlight developments and trends in child health, locally and internationally.

Established following a landmark gift from Dame Marit Mohn (MSc Chemical Engineering and Chemical Technology 1973), the Centre’s research and partnerships aim to transform urban living for children, particularly those in society’s most deprived communities.

The Centre will unpick the complex network of interactions between environmental, behavioural, genetic and molecular factors to address important physical and mental health challenges and health inequalities. It will be an advocate for the good health of children and young people among policymakers, to ensure its research has the greatest impact.



**Inspiring minds**  
The Mohn Centre has been working with children and young people from across White City.

PHOTO: JO MIESZKOWSKI. ILLUSTRATION: MIKE LEMANSKI



*The Hitchhiker’s Guide to the Galaxy says 42 is the answer. But what is the question? For Russell Miller it is: how can we use AI to personalise our learning process?*

**Is AI a threat or an opportunity?** For Russell Miller, whose team is focused on creating the learning programmes of the future, it’s very much a chance to make a positive change.

“We’re examining how AI can help make learning relevant to our personal needs by understanding what we know already,” says Miller, whose team at the Imperial College Business School – with, he says, “one foot in the future” – builds executive education programmes.

He uses the British love of tea as an example. “As a lifelong coffee drinker, it would be useful for me to go through a whole course on tea-making – whereas a regular tea drinker would be extremely bored and might only get something from the final afternoon.” Which is where personal adaptive learning comes in, he says. This technology uses AI to establish what learners don’t know. “It’s a really cool way of accelerating impact, particularly for companies who want to take their people through repeat compliance courses every couple of years,” he points out.

Ultimately, rather than spending 90 minutes clicking through answers simply to get to the end, the hope is to use personalised adaptive learning to make this kind of training more effective – and to build out for non-technical areas. Miller hopes that more efficient ways of running courses could eventually be applied to abstract subjects like leadership.

The team is also researching the impact of company culture on AI in learning environments, and how to get everyone on board. “There’s a matrix of AI adoption in terms of mandate and innovation and you see it across Imperial, too, which is fascinating,” he says. “Despite the occasional scepticism that AI will put us out of jobs, you get a lot of pockets of real enthusiasm and a strong mandate to go off and try it. It’s really positive.” ♦

> *Russell Miller is Director of Learning Solutions and Innovation at Imperial College Business School.*

# Go Bo...

Near, far, in a motor car? Maybe, but don't sing it near the team. Meet City & Guilds' four-fendered friend.

Words: **Greer McNally**  
Photography: **Joe McGorty**

If you've seen a maroon 1902 vintage motor slowly cruising through South Kensington, then you may have already witnessed the spectacle that is Team Bo' (Boanerges). The car – and the Imperial society members in top hats and oil-soaked striped suits who maintain him – are often seen out for a test drive near the Royal Albert Hall (their garage is round the back). Travelling at just 20mph, they've been mistaken for Santa's sleigh, asked for a lighter and even been compared to Chitty Chitty Bang Bang. "I'm just glad they don't sing that at us when we do our Christmas lights trip to the West End," says Bo's designated driver, Dana Gadd.

Gadd is also the society's Chair, but she almost didn't join the group of automotive enthusiasts when she first arrived at Imperial. "I had seen the university's vintage fire engine Jez (short for Jezebel) first," she explains. But when the freshers' fair rolled round the fire truck was out of action. "I went and Jez wasn't there – and then I saw Team Bo' and I just knew it was for me. That year's Chair had even grown a moustache especially and used a glue stick to curl it up. It was both hilarious and very cool."

Gadd already had a love of tinkering with engines when she came to the club. But she wasn't sure that was enough automotive experience, so decided to try one session and see how it went. "Basically," she says, "I just never left."

She explains, that while most of Team Bo's time is spent looking after the car, the society also owns a vintage 1926 motorcycle. "He needs a little TLC at the moment and we're always looking for riders. The motorcycle is technically quite powerful, so you have to have some experience to ride it."

Gadd and the rest of the team are still glowing from the high point in the Team Bo' calendar – the car's annual run to Brighton in November. As she shares her experiences of the sunrise to sunset race, which features more than 300 vintage vehicles, her face lights up. "There are so many stories and they almost always involve us breaking down," says the smiling aeronautical engineering student. It's clear that the challenge of maintaining a car made over a century ago is one she enjoys. She tells how on one



occasion the exhaust pipe hit the tarmac mid-race, but she's also lost driving pins, had to rebuild a shaft and even helped with a full refit of the car since joining the society.

And her favourite moment on a run? Gadd doesn't even pause, as she recounts how Bo's handbrake lever fell off near the finish one year. "We were so close to the end, so we zip-tied it on. But then it fell off again and another car ran over it. But we were determined not to give up, so I drove the rest of the way into Brighton without a handbrake. I was basically manually pulling on a piece of wire, so I was pretty proud that we finished that day."

Now in her fourth year, Gadd is currently training Bo's next driver and handing over the steering responsibilities to someone new. But she'll never forget her time behind the wheel. "We've got this really cool photo – it's just got a zoom of power going past. It was taken on a test drive the night before a Brighton run. It's just one of many memories I have from being part of Team Bo' that I'll never forget." ♦

There are so many stories and they almost always involve us breaking down



#### STOLEN GOODS

Bo and Jez have often been part of one of Imperial's oldest traditions: mascot theft. Union President 2011-12, Scott Heath, described it as "an adults' game of hide and seek – those caught attempting to steal have faced retaliation, such as being covered in motor oil, wood chips and a can of lasagne, before being set free." Don't say you weren't warned!

> *Have you heard of – or been involved in – any 'escapades' involving Imperial mascots? We'd love to hear your stories of either taking or retrieving mascots, via [imperialmagazine@imperial.ac.uk](mailto:imperialmagazine@imperial.ac.uk)*



Main image from left to right: Ash Robson, Third year Aeronautical Engineering; Jack Swires, Third year Physics; Fedor Shchemerov, Third year Biomedical Engineering; Sean Mabiassan, Third year Mechanical Engineering; Dana Gadd, Fourth year Aeronautical Engineering.

# Bill imagined a better world, with a gift in his will

Why alumnus Bill Anglesea chose to leave a legacy for future generations at Imperial College London.

Bill Anglesea (Chemical Engineering 1962) loved his time at Imperial in the 1960s. As his cousin, Jenny, puts it: "He always said he felt privileged to study Chemical Engineering at a true centre of excellence for his subject." He grew up with his mum and aunt in a two-up, two-down terrace in Wigan.

His family valued education, and from an early age Bill saw it as a pathway to success. He also knew first-hand the life-altering impact of financial support; he had attended Wigan Grammar School on a scholarship, and was also awarded a scholarship to study at Imperial.

## Passing it forward for the next generation

Bill met his wife Alison in his 40s, and they loved to travel and explore the countryside together. He was devastated when Alison passed away suddenly as a result of medical negligence, and he was proud to create a scholarship in her name for students studying medicine at Imperial, a place that had given him such opportunities.

When Bill died recently, he made donations to more than 50 people and causes in his will, including a very generous gift to create a second scholarship for future students in engineering at Imperial.



People who leave a gift in their will make an incredible difference. They make possible the futures that many people deserve but, without financial support, would never have.

Martin Lupton, Vice-Dean (Education), Faculty of Medicine

Imagine a brighter future – make a gift in your will today

A gift in your will can give future generations of students and researchers the chance to thrive at Imperial and beyond. You'll also be playing your part in research breakthroughs that tackle some of the world's biggest global challenges. For more information on leaving a gift in your will, get in touch with Anna Wall, Head of Regular Giving and Legacy Giving, on +44 (0)20 7594 3801 or email [a.wall@imperial.ac.uk](mailto:a.wall@imperial.ac.uk)

EDUCATION – SARAH RANCHEV-HALE, HEAD OF IMPERIAL ENTERPRISE LAB

## A base for entrepreneurial activity offering the right advice – at just the right time



There are many misconceptions about how easy – or hard – it is to become an entrepreneur. Some underestimate the challenges, thinking that just because they have a great idea, the rest will fall into place. But others go the other way, imagining they have to give 100 per cent all the time and stay up until 4am every day.

And that matters, because Imperial students are natural problem solvers who see the issues facing the world, and think: 'How can I fix this?' At Imperial's Enterprise Lab, we help them to do that by offering the right advice at the right time.

Since 2016, the Enterprise Lab has been a base for entrepreneurial activity. Many Imperial people have the imagination and the technical ability to create a solution to a problem but might not know how to get that idea out into the world, to articulate it or speak to end users or investors. That's where we come in, creating a community where everyone, at every stage of their journey, can learn from each other.

The Enterprise Lab supports people in several different scenarios. If you'd just like to develop your entrepreneurial skills or connect with different people across the university, you could take part in our termly Idea Challenges. Here, you're put in cross-disciplinary teams, set a problem and then given support to generate a new idea. Or you could attend one of our Community Colliders, which bring together everyone from undergraduates to alumni to make new connections. We also organise open source sessions available to everyone, in which we share general entrepreneurial knowledge.

If you have formulated a specific idea and are keen to build a business around it, you can apply to join our two cohort-based programmes. The Venture Catalyst Challenge offers a three-month programme of one-to-one coaching, expert advice, evening workshops and pitch training, all focused around your specific business and developing your knowledge and skills to bring it to commercial reality. And WE Innovate, which recently celebrated its tenth anniversary, supports women-led teams to develop entrepreneurial leadership skills and launch and scale new ventures.

We also offer support to those who have tested and validated their idea and are ready to further build their startup, via business coaching, the Imperial Venture Mentoring Service, access to our Experts-in-Residence, and pro bono and bespoke advice as and when they need it, to help with any potential legal issues for example.

And even if at the end of the programmes, people decide not to pursue their startup, it's still a positive experience – sometimes they go away and tweak their concept, or sometimes they realise it was just the wrong idea, but they've learned so much with us that they're ready when they do find the right one.

Since the Enterprise Lab was established, we have helped more than 350 startups incorporate, which have raised more than £570 million in investment capital. But just as importantly, it's encouraged entrepreneurial mindsets, creative thinking and the formulation of ideas. We don't assess whether an idea is any good or not. What we will do is equip you with the tools to come to your own conclusions. Whatever your plans, we help you to explore them without judgment.

Having said that, we have seen some genius solutions. I was at the Imperial College Business School before coming to the Enterprise Lab, and I had absolutely no idea how amazing some of these startups are. I'm constantly blown away by

## Whatever your plans, we will help you explore them without judgment

the weird and wonderful ideas that we see, such as Untap Health, community sewage monitoring that can identify viruses and bacteria days before symptoms show, and Cyanoskin, new carbon capture technology utilising an algae-based coating designed to transform buildings into carbon dioxide-absorbing structures.

And what's threaded through is the desire to tackle real-world issues. This tends to be the positive mindset Imperial gives its students: 'Here is a problem, someone needs to solve it, I can be that person.' Here at the Enterprise Lab we help them make that happen. ♦

IMPERIAL INNOVATES

## Plotting a cancer revolution

Dotplot's Shefali Bohra and Debra Babalola want us to take breast cancer screening into our own hands.

Words: **Kat Brown**

**W**e know that breast cancer is a devastating disease, claiming 31 lives in the UK every single day. We know that early detection can make a huge difference – survival rates increase to up to 93 per cent. So we know we need to be checking as often, and as thoroughly, as we can. But what we don't always know is how to do that effectively.

Shefali Bohra and Debra Babalola (both MSc Innovation Design Engineering 2022) hope to change that. The two are co-founders of Dotplot, a handheld, at-home breast health

“The more we researched, the more we realised that there was a huge opportunity to develop something that could revolutionise women's breast healthcare,” says Babalola. “It's an area that's been really underserved, just in industry in general. So we thought, how can we apply our design and engineering skills to actually solve that gap?”

During their Master's course, the pair won a £30,000 funding prize from the Venture Catalyst Challenge. “The prize enabled us to work on our proof of concept and pay ourselves a salary,” says Bohra. “It motivated us to

from us,” says Babalola. “For example, what would help speed up referral processes, or help GPs make more informed decisions about who to refer?”

They also hope to design their first clinical trial, which is expected to take place in 2025. “We are still some way from establishing how well we can differentiate between cysts, tumours or other complications,” says Bohra.

The aim is to be on the market within the next three to four years – with the right funding. “You can be surprised about how willing people are to help you up,” says Babalola.



device that identifies changes in breast tissue density over time. Paired with an app, it guides users through monthly self-checks and alerts them to abnormal changes.

Breast cancer may or may not exhibit any physical changes on the surface of the skin, which is why women are encouraged to perform self-checks on a regular basis. However, current guidance is mostly limited to demonstrations and pamphlets – not the easiest way to explain the difference between normal and abnormal breast tissue. By addressing the confusion and guesswork associated with self-checks, Dotplot hopes to customise guidance and offer objective monitoring.

pursue the project and apply for other grants. In May 2024, Cancer Research UK named us New Startup of the Year, so that was another £15,000, which was great. We were up against some really fantastic startups who were mostly in the diagnostic and therapeutic space, so we didn't know if this home pre-screening tool was going to resonate. It was a huge honour to win.”

The next step is to carry on developing the product, particularly to investigate how it could support the work of healthcare professionals. “We will be exploring whether the breast self-check reports that Dotplot generates can be of use to GPs and, if so, what kind of information they require

**Driving force:** Shefali Bohra and Debra Babalola, postgraduates in the Dyson School of Design Engineering.

PHOTOS: ©JAMES TYE

### We realised there was a huge opportunity to revolutionise women's breast healthcare

“Most people recognise that there's a space for everybody to thrive, so it's about sharing knowledge and doing whatever we can to address cancer research. From investors, there's a genuine concern for patients and the population when it comes to cancer research and focus. It's really inspiring.” ♦

> [Find out more at dotplot.co](https://dotplot.co)

#### IN BRIEF

##### Student survey results

Student satisfaction at Imperial is in the top quartile of the Russell Group, according to the new National Student Survey. The latest Survey – with a response rate of 74 per cent – showed that satisfaction has increased in three areas: organisation and management; freedom of expression; and student awareness of mental health and wellbeing services.

##### New health science director

Professor Mark Thursz has been appointed Director of Imperial College Academic Health Science Centre, a new strategic partnership aiming to speed up the real-world impact of scientific breakthroughs on patient care and public health. Thursz is Professor of Hepatology at Imperial, Consultant in Hepatology at St Mary's Hospital and Director of the NIHR Imperial Biomedical Research Centre.

##### Satter Prize winner

Professor Ana Caraiani has won the Ruth Lyttle Satter Prize from the American Mathematical Society for her work on the Langlands Program, one of the most ambitious projects in modern mathematics. The award honours Caraiani's contributions to arithmetic geometry and number theory, which builds upon the proof employed in Fermat's Last Theorem.

#### OVERHEARD ON CAMPUS

*Sofa subscription: Too many sofas are being sent to landfill, so Imperial students are working with furniture giant DFS to find more sustainable ways of building and buying them. Ideas include modular sofas and sofas that can be rented and sent back for reuse.*

*Night owl: Researchers looking at how sleep affects brain performance have found that self-declared 'night owls' who prefer doing things in the evening tend to have higher cognitive scores.*

*Badgers: The number of badgers testing positive for TB has dropped from 16 per cent to zero in a study area covered by a badger vaccination programme co-managed by farmers, scientists and conservationists.*

# SCIENCE FOR HUMANITY



Imperial has a vision: to shape the future and be a force for good in the world. How to get there? By daring to dream, and setting out a plan to discover, create, explain and transform.

Words: Lucy Jolin / Illustration: Pong



It's one thing to be a world-leading university. It's quite another to be a world-changing one. That's why, a year ago, Imperial staff, students, stakeholders and alumni

came together to discuss, debate, challenge and finally agree on just how the university intends to make that difference. "We needed to do this, because we are a wonderful community of problem solvers," says Professor Hugh Brady, President, "and because we compete successfully with the top ten research universities in the world – despite having much shallower pockets."

After all, if you want to change the world, says Professor Mary Ryan, Vice Provost for Research and Enterprise, you have to acknowledge that the world is changing – very quickly. "It's a time to take stock and think about who we are and what we are for. We have a longstanding mission to deliver benefit to society: what does that mean in a global context in 2024? What will that mean for universities in 2040? How do we navigate changes and stay attuned to our principles? How do we position ourselves to be the voice that continues to speak truth? And – this is so important – how do we bring everyone with us? This is about leveraging every part of Imperial's strength to make the world a better place. And we want everyone to be part of it."

The result of this university-wide consultation is Science for Humanity, which sets out a new strategy for Imperial (in an

admirably succinct 20 pages) by asking and answering a very simple question: how do we maximise our potential as a force for good in the world? That question, Brady says, has enabled Imperial's community to deep dive into just what makes the university so different – and so special: "Our secret sauce, if you like!"

Brady highlights the key factors: Imperial's rare focus on both STEM and business; its longstanding ease with interdisciplinary working; its emphasis on innovation; and its London location. "It's a phenomenally exciting set of ingredients to play with." Out of these ingredients have come the nine big plays that make up Science for Humanity. They're all ambitious, they're all practical, and they're all happening right now.

## BRINGING EXPERTISE TOGETHER

First up: the world's biggest challenges – from climate change to infectious disease – are all deeply interconnected, and consequently require cross-disciplinary thinking to solve. So four new Schools of Convergence Science will be created, bringing different and deep disciplinary expertise together to create the biggest possible societal impact in: human and artificial intelligence; health, MedTech and robotics; climate, energy and sustainability; and space, security and telecommunications. "We use the word 'impact' a lot in the higher education sector, and ▶

## The Big Nine:

Clockwise from left

1/ *Class of 2030*  
A programme to nurture this most talented, enterprising and diverse graduating class.

2/ *Imperial Empowers*  
The Institute of Extended Learning will help future proof careers, businesses and communities.







**Impact for us means having a positive effect on people's lives**



**The Big Nine cont...  
Clockwise from left**

**3/ Sustainable Imperial**  
A commitment to play a leading role in the global fight against climate change, biodiversity loss and pollution.

**4/ Imperial Innovates**  
Scaling up Imperial's world-class innovation ecosystem for world-changing impact.

**5/ Imperial Global**  
A new network of collaboration will help Imperial meet the global grand challenges.

**The strategy's nine big plays are ambitious, practical and they're all happening now**

sometimes we use it nebulously," says Ryan. "We've tried to think what we actually mean by impact. And from an Imperial perspective and from Science for Humanity's perspective, it means having a having a positive effect on people's lives."

But these life-enhancing ideas need to be spread, to be created, to be translated – so Imperial Innovates will scale up its existing ecosystem even further.

The Imperial WestTech Corridor will become a world-leading hub for entrepreneurship and tech advancement, while the Imperial Institute of Extended Learning will enhance innovation ecosystems with advanced skills and leadership training for businesses, individuals and knowledge organisations. Imperial Global will create convening points across the world to bring in yet more ideas, talent and innovation. And to ensure the university practises what it preaches, Sustainable Imperial will set

a global benchmark for university sustainability. Of course, Imperial will need to continue to attract the brightest minds from across the world: that's where the Imperial Inspires scholarship programme comes in. Once this next generation of innovators, researchers and entrepreneurs has arrived, the Imperial Class of 2030 programme will encourage, skill up and inspire them. As they enter their early careers, the Imperial Future Leaders Academy will provide them with sector-leading opportunities.

None of this would be possible without what's already there. "These concepts of strong disciplines and cross-disciplinary working at scale are really a USP for Imperial," says Professor Ian Walmsley, Provost. "We're about fostering the sense and spirit of entrepreneurial activity, whether that's in your own research or in delivering outside work. That's what the strategy is essentially about: us doing that here and out in the world, reaching out to new groups, and harnessing those for the larger benefit."

Indeed, Brady is keen to point out that while Science for Humanity is far-reaching and ambitious, it also recognises those things that Imperial already does brilliantly, and that won't change at all. "We will continue to invest in research areas where impact is less obvious. For example, pure



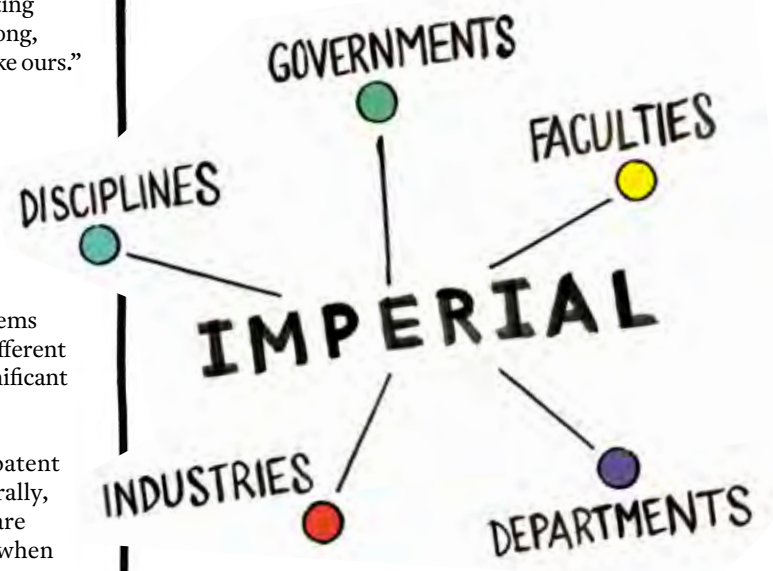
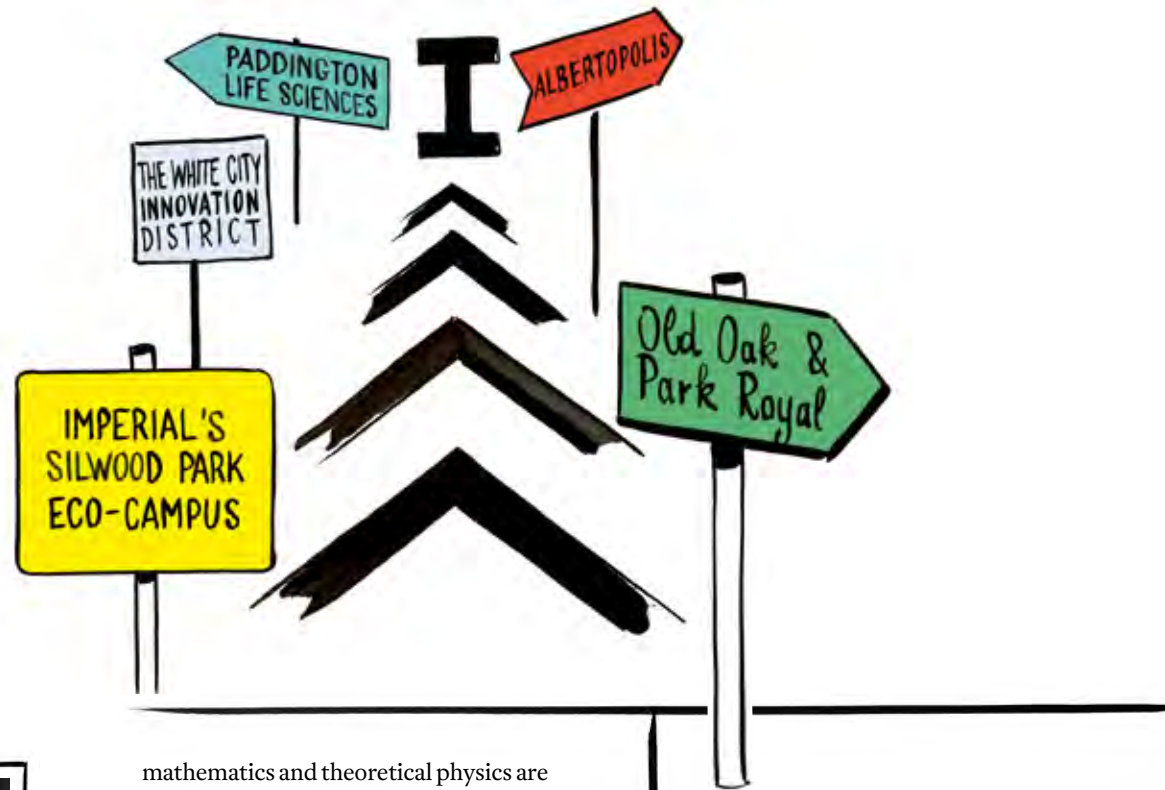
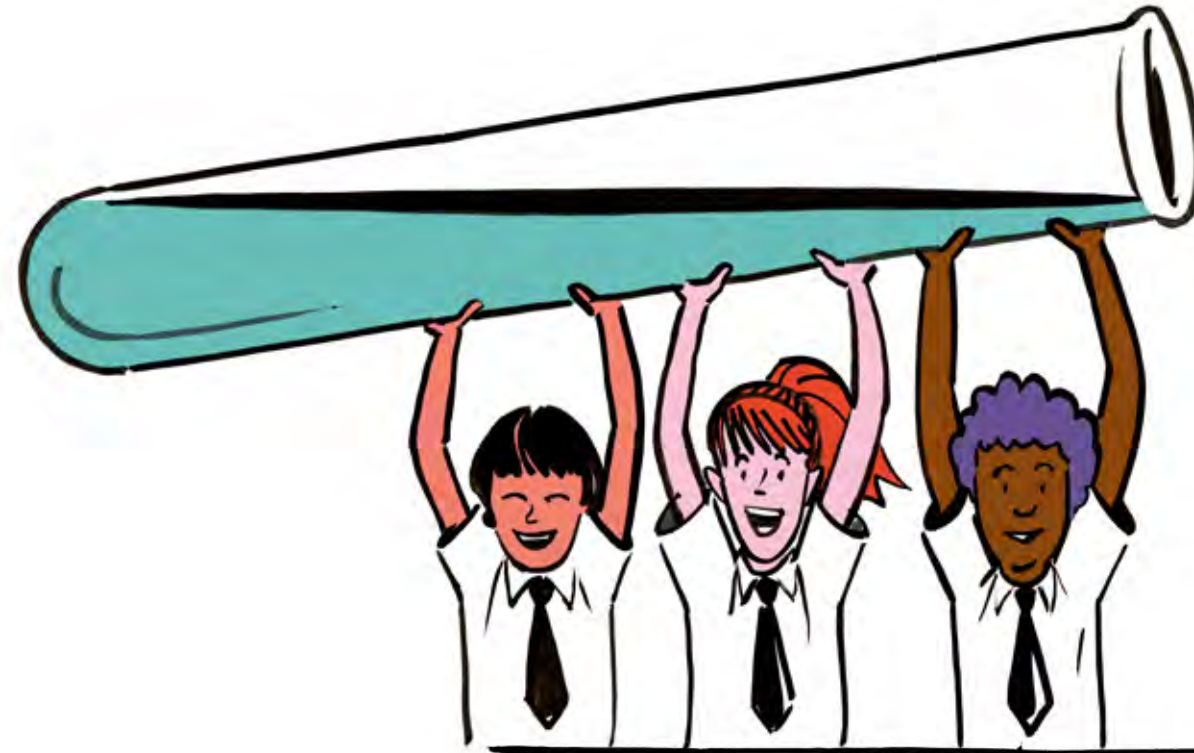
The Big Nine cont...  
Clockwise from top left

**6/ WestTech Corridor**  
Creating a vibrant new ecosystem to be a catalyst for investment, jobs and inclusive growth.

**7/ Imperial Inspires**  
A scholarship programme designed to attract and inspire young minds.

**8/ Imperial Futures**  
Four new Schools of Convergence Science will create a new paradigm for scientific exploration.

**9/ Imperial Talent**  
The Future Leaders Academy will attract and nurture the next generation of STEM leaders.



mathematics and theoretical physics are meritorious in their own right. The way they approach problem-solving is also incredibly important for the multidisciplinary mix we will create. And you can't do cross-cutting like that unless you have incredibly strong, independent academic departments like ours."

Walmsley sees the new strategy as enhancing the vibrancy of Imperial's intellectual environment: the new scholarship will bring in new groups of students, he points out; cross-disciplinary teaching and thinking will enable them to learn in a whole new way; and faculty will be able to discuss a multitude of big problems and challenges with colleagues from different disciplines. "That, I'm sure, is how significant new ideas will emerge."

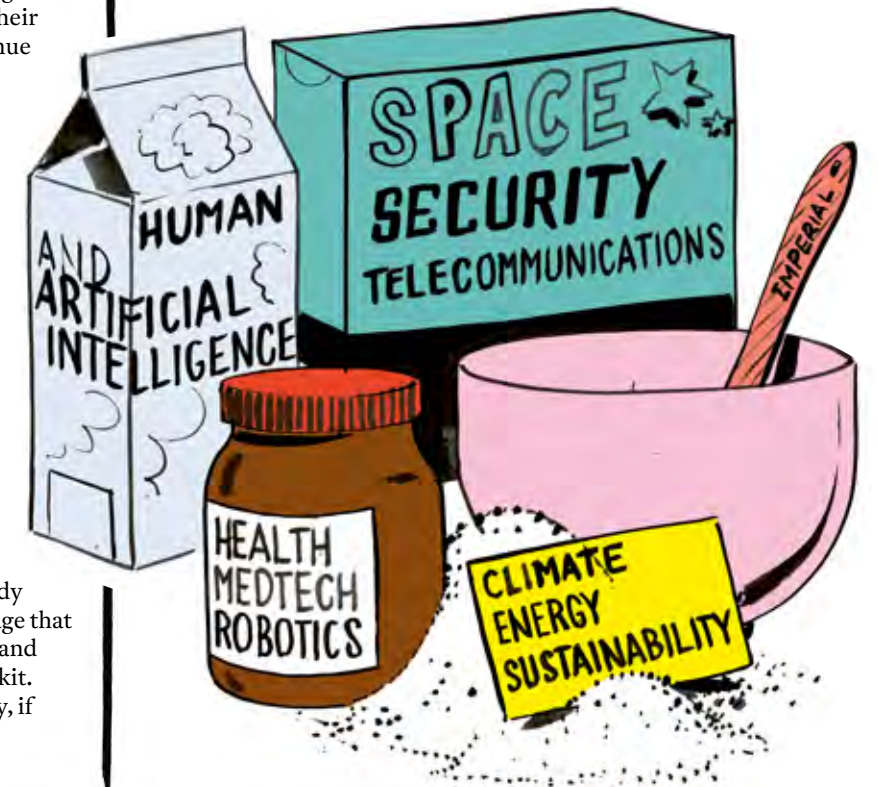
How will its success be measured? With scorecards, rankings, surveys, patent numbers, and startup numbers, naturally, but also via less tangible factors that are hard to measure – but unmistakable when you're in the room with them. "For me, success would mean that Imperial continues to grow in this intellectual vibrancy that attracts people," says Walmsley. "That people want to come to Imperial because they see this as an exciting place where they can explore their ideas. They'll know that they will find like-minded individuals who can help drive their work and their thinking, and that their work will have impact outside their immediate laboratory. It will mean that people in institutions around the world will say that Imperial is a good place to be."

Now the hard work begins to make sure that Science for Humanity fulfils its promise. The biggest challenge is, of course, funding. "There is a vast gap between what we receive on an annual basis, and what superbly endowed US universities and the emerging powerhouses of Asia with very strong government support receive," says Brady. "Now we have our strategy, we will focus on our philanthropic ambitions. I have been very encouraged by alumni urging us to do this. They are incredibly proud of their alma mater, and they want us to continue to be successful."

"In strategy, as in science, there is no easy prophecy and no shortcut to progress," Brady points out. "But what worthwhile endeavour was ever easy? This strategy will allow us to do together what we can't do individually."

"I remember one meeting where the students pointed out that they were worried: about pandemics, the economy, the climate, sustainability. They said: 'We want a strategy that gives us hope.' And Science for Humanity does that. It will make a difference. We will make a difference. I'm excited by it and I'm excited by the response to it, by our community urging us to go the extra mile. It's already opened new conversations. It's a message that is really resonating with students, staff and partners, and alumni. We have the toolkit. We have the ingredients. Because really, if Imperial can't do it, then who can?" ♦

**This strategy will allow us to do together what we can't individually**



**Professor Hugh Brady**  
Imperial's 17th President and member of the Royal College of Art's Council.



**Professor Ian Walmsley**  
Provost since 2018 and Chair in Experimental Physics at Imperial.



**Professor Mary Ryan**  
Vice Provost for Research and Enterprise and the Armourers and Brasiers' Chair for Materials Science.

# PAEDIATRIC

CHILDREN ARE SEVEN TIMES MORE LIKELY TO DIE FROM BLAST INJURIES THAN ADULTS. BUT HELP IS AT HAND.

# BLAST

# INJURY STUDIES

Words: **Lucy Jolin**

**IT'S AN ALL TOO FAMILIAR NEWS ITEM:** exhausted emergency workers pull a child, alive, from the rubble of a bomb-shattered building. The camera zooms in on the faces of the child's parents, weeping with joy: in our cosy living rooms, we rejoice with them. But that child's survival is just the beginning of the story, as those at the Centre for Paediatric Blast Injury Studies know well.

"It's wonderful when a child is rescued, but if you work in paediatric blast injury, you know there's a good chance that those child's legs are going to have to come off," says Dr Emily Mayhew (MSc History of Science, Medicine & Technology 1999), resident military medical historian at the Department of Bioengineering. "You might see a follow-up story of that child on their prosthetics, dancing and joyful. But you know that in six months' time, their caregiver may have to make a long, expensive journey to a hospital. Those stumps might have to be re-operated on. Money will have to be found for a new prosthetic, and there will have to be more rehab. The rest of that child's life will be extraordinarily difficult."

It is the Centre's mission to make that child's life less difficult. Officially opened in March 2023 with funding from Save the Children, it was the logical next step for Imperial's Centre for Blast Injury Studies, founded in 2011, which addresses the disabling injuries of conflict in adults. "We had to ask: 'What about children?'" says Mayhew.

It's a pertinent question, because child victims of 21st century wars are far more likely to suffer blast injuries than those of the 19th and 20th centuries, who were mostly affected by starvation. Wars are now mostly fought in cities – where children live. Their homes are in buildings that are bombed or hit with rocket-propelled grenades. And they also come across explosive weapons such as landmines in the ground, either deliberately left there or left over from previous engagements.

Indeed, the focus on children is vital, says Professor Anthony Bull (Mechanical Engineering 1992; PhD 1995), director of the Centre, for one very simple reason. Children are different from adults, chiefly because they grow. Yet research into child-specific blast injuries thus far has been limited, or non-existent. Bull recalls his experience chairing the expert panel for blast injuries for the Manchester Arena bombing inquiry in 2021 – a terrorist attack in which 22 men, women and children died. "Questions arose that we couldn't answer because the research wasn't there," he says.

Military medical experts in the field can have considerable expertise in treating children, he points out, but they are not set up for it, and their expertise is rarely codified in a way ▶



**Sanaa, Yemen, October 2018**  
Yemeni girls Hala Majed Oqbah (in blue dress) and Aradah Mohammed Oqbah, who both lost one leg in an airstrike while they were playing outside their house in Ibb province, try out prosthetic limbs provided by UNICEF at a rehabilitation centre in Sanaa. Aerial attacks and street fighting took hold of most of Yemen in 2015 and put millions of civilians, especially children, in danger.





**Professor Anthony Bull**  
Professor of  
Musculoskeletal  
Mechanics.



**Dr Emily Mayhew**  
Historian in Residence  
in the Department  
of Bioengineering.



**Claudia Ghidini**  
PhD student working  
on prosthetic provision  
for children.



**Caitlin Edgar**  
PhD researcher in  
Low-Cost Paediatric  
Prosthetic Limbs.



**Sumudith Jayasuriya**  
PhD student in  
Bioengineering and  
Biomedical Engineering.

**Leogane, Haiti,  
January 2010**  
Measurements are  
taken of the stump  
of a young woman  
who lost her leg in  
the January 2010  
earthquake, to fit  
a new artificial limb.



that others can learn from. Examining how blast injury affects growth, for example, requires long-term research: impossible to carry out when trying to cope with the immediate impact of conflict. This led to the publication, in 2019, of the Paediatric Blast Injury Field Manual, by a coalition supported by Imperial and Save the Children – the first comprehensive guide to treating those injuries. “And we published a systematic review, which showed what we knew about children with blast injury, and what we didn’t know,” says Bull. “This led us to the Centre’s research agenda.”

A key part of that agenda is finding new and better prosthetics for that child in the rubble, as well as victims of blast injury, as both will frequently require amputations. It’s a huge challenge that PhD students Caitlin Edgar (MEng Bioengineering 2021) and Claudia Ghidini (MSc Bioengineering 2021) are determined

to overcome. Edgar is designing an entirely new, adjustable and affordable prosthetic knee joint for children in low-resource environments. And Ghidini is designing a new socket – the interface between the residual limb and the rest of the prosthetic leg.

“A prosthetic is a life-saving device,” says Edgar. “If you are in a conflict zone, you need your mobility back to flee conflict, to ensure your continued health and wellbeing, and, specifically for children, to get back into education and continue to develop into adulthood. Without appropriate prosthetic care, children will not reach their full potential.”

The two had little child-specific research to call upon. So before they started the design process, they took a step back and created their own body of literature, using case files from Cambodia and questionnaire-based study of children with limb loss in Cambodia

and the UK. It gave them crucial insight into the challenges these children face, the impact of the injury, the problems with the prosthesis, and their wishes for the future.

Partnerships are vital: they include work with the Department of Prosthetics and Orthotics in Cambodia, the social enterprise Exceed Worldwide, and the Royal National Orthopaedic Hospital in the UK. There is also emphasis on the extensive expertise of Professor Bull’s group, and Imperial prosthetics spinout GO Assistive Technology.

The pair’s research revealed a multitude of issues. Children with an unsuitable prosthetic can struggle to walk on uneven ground, which is common in conflict zones or rural areas. This can make the leg lock straight, impacting the rest of the body. There is no knee joint small enough to fit very young children. As they grow, the prosthetic frequently needs to be replaced. An ill-fitting prosthetic can cause numerous lifelong problems such as scoliosis and osteoarthritis, as other limbs and joints attempt to compensate.

Similar problems arise with the socket, the interface between the residual limb and the prosthetic leg. “Children told us that they have a lot of issues with pain, as they keep growing and the socket gets tight,” says Ghidini. “This causes problems with the residual limb such as blisters or small wounds, which means they can’t wear the socket. They would like to be able to adjust the leg themselves, so they don’t have an expensive journey to the clinic and miss school – and they would like it to look more like a ‘normal’ leg.”

Ghidini is just about to start her design process, while Edgar’s new knee design will soon enter its first trial. Her improved knee is suitable for children throughout their growth, with an increased range of motion that allows for

kneeling. “The leg length can be increased by two centimetres, which might not seem like a lot, but is two to three years’ growth for a child,” she explains. “It doesn’t need cutting or taking apart: it just slides out and can be done immediately and is easily repaired using parts from bicycles.”

## NEW STRATEGIES

But developing new prosthetics that work for children also demands fundamental knowledge about exactly what blast injuries do to a child’s body, and how that differs from the same injury for an adult. “First is the injury you can see: the fragments, the bits of rubble that smash into the human being and blow holes in them,” says Mayhew. “But there is also an invisible blast wave which passes through their body and disorders systems at the genetic level. We know from adult studies that this primarily disorders healing: soft and hard tissue, bones and skin. It doesn’t heal. It doesn’t scar. It doesn’t re-form, and it affects people for the rest of their lives.”

PhD student Sumudith Jayasuriya is seeking to fill this key knowledge gap. His work focuses on two different bone growth abnormalities that can follow traumatic injuries. Because child amputees have immature skeletons, bone can grow from their amputated limbs. It’s not just painful and irritating, but also makes putting on and wearing prosthetics much more difficult, which impacts their ability to take part in daily life.

And growth plate disruption, caused by the blast wave, can lead to growth problems. These cartilaginous regions sit towards the ends of long bones in children – when they are damaged, they affect bone growth. “For example, an injury towards the centre of the growth plate can lead to relative shortening of that limb compared to an unaffected limb,” explains Jayasuriya. “An injury to the lateral side of the growth plate can lead to uneven growth, where one side grows longer than the other.” This could lead to the children developing problems such as osteoarthritis or scoliosis or having difficulties performing basic activities.

“We want to use our model to demonstrate that existing prophylaxis are not ideal,” says Jayasuriya. “We also want to explore the effects of different mechanical loading environments, to see if this can reduce bone overgrowth, which could provide a contemporary new therapeutic strategy for dealing with this condition.”

The challenges this team faces are vast – but the potential impact on children’s lives is even more so. “At the Centre, we like to say children are little human beings, not little adults,” says Ghidini. “Everything they need and the problems they face are so different – and so often, they are just forgotten. I hope that we can pave the way for new engineering solutions and rehabilitation methods, reduce pain and give them a better life. I hope we can allow them to just be children.” ♦

PHOTOS: THIS PAGE: ©FLORIAN KOPP / ALAMY. PREVIOUS PAGE: ©XINHUA / ALAMY

T O M O R R O W ' S



**AMAURY DE REUVER**  
Age: 15  
Attends: Makerspace  
What's going on: Made from colourful acrylic and decorated with LED lights, this Carbon Catcher is a prototype of a drone that's designed to fly over highly polluted areas to filter out carbon dioxide emissions. Amaury says he's more self-confident with peers thanks to connecting with like-minded people at Proto Maker and Maker Challenge events.

M I N D S

Outreach at Imperial is 50: five decades of inspiring young minds and creating big futures. ▶

Words: Peter Watts / Photography: Joe McGorty



A

**smart sleep mask for people with insomnia.** LED lamps powered by gravity. Glasses for people with hyper-sensory issues. These are the fantastical inventions of the future, made by the inventors of the future, energised teenagers spending their summer on the Maker Challenge – one of many Outreach programmes run at Imperial. Here, they have access to cutting edge equipment at the Dangoor Reach Out Makerspace on Imperial’s White City campus where they can bring their ideas to life.

“These activities really help to inspire the youngsters, and you see them learn and grow in confidence,” says Evo Tongomo (Geology 2024), who supports Outreach programmes as a Student Ambassador. “At the end of the sessions, their teachers say they are completely different to what they are like at school.”

The Maker Challenge ignites a fascination with STEM, which has been the purpose of Imperial’s school engagement since its origins in 1975 as the Pimlico Connection, a project that saw Imperial students mentoring children at local schools. Over five decades, this has blossomed into a huge portfolio of programmes that includes summer schools, tutoring programmes, homework clubs and science competitions, delivered with the help of Student Ambassadors such as Tongomo and designed to raise the profile of science while supporting students from under-represented and disadvantaged backgrounds. This 50-year milestone is being celebrated this year through a series of interviews with alumni and current students who have been part of the programmes.

The Pimlico Connection is the programme that started it all, but the Outreach team’s dedicated spaces have been key to the flourishing

programmes on offer today. This includes the Makerspace in White City, partly funded by alumni donations, as well as the Wohl Reach Out Lab in South Kensington, which opened in 2010. Around 4,000 schoolchildren use the Reach Out Laboratory each year, but the lab itself might never have existed without the lobbying power of Lord Robert Winston, Professor of Science and Society and Emeritus Professor of Fertility Studies.

As part of the Outreach work, Lord Winston visits schools throughout England and Wales – in busy years he has talked to more than 50,000 children face to face (he believes this has much more impact than online teaching). This is a service that Imperial provides for free to any school interested.

Though things are improving, some UK schools do not have adequate, safe laboratories where children can do messy experiments which are so much fun. Winston remembers one lesson “with a boring old master gabbling for ten minutes,” he says. “Then suddenly a monumental explosion filled the room with smoke. He had set it up before the lesson. Things like that made me want to be a scientist.” This is why Winston founded the Reach Out Lab at Imperial, welcoming children of all ages to do exciting experiments supervised by excellent role models: young university students and staff.

The Reach Out Lab allows school pupils to access Imperial facilities and take part in practical experiments. It engages them at a young age, opening their eyes to the possibilities of STEM, universities and Imperial in particular. “The role model aspect is very important,” explains Dr Melanie Bottrill (MSci Chemistry 2004; PhD 2009), Head of Outreach Programmes. “It gives the children someone they can more easily relate to. And because we have been tracking outcomes, we know we have ambassadors who first engaged with Imperial when they attended summer schools as schoolchildren themselves.”

Take Dr Jad Marrouche (Physics 2007; PhD Experimental Particle Physics 2010). He first encountered Imperial while studying A-level physics at Holland Park School. An Imperial undergraduate began visiting the school as part of the Pimlico Connection, and persuaded the school to enter a physics competition run by the Institute of Physics. Marrouche’s eyes were opened, and he and his friends decided to participate in Imperial’s summer school. “That was our first real insight into life beyond school and it galvanised us,” he says. “It was this whole other world we had never known about before.”

Marrouche would go on to work at CERN, but while at Imperial, he volunteered as a Student Ambassador with the Pimlico Connection. “As a mentor, I had to inspire GCSE students and explain simple physics concepts through analogies they



**JAVERIA SAEED**

Age: 17

Attends:

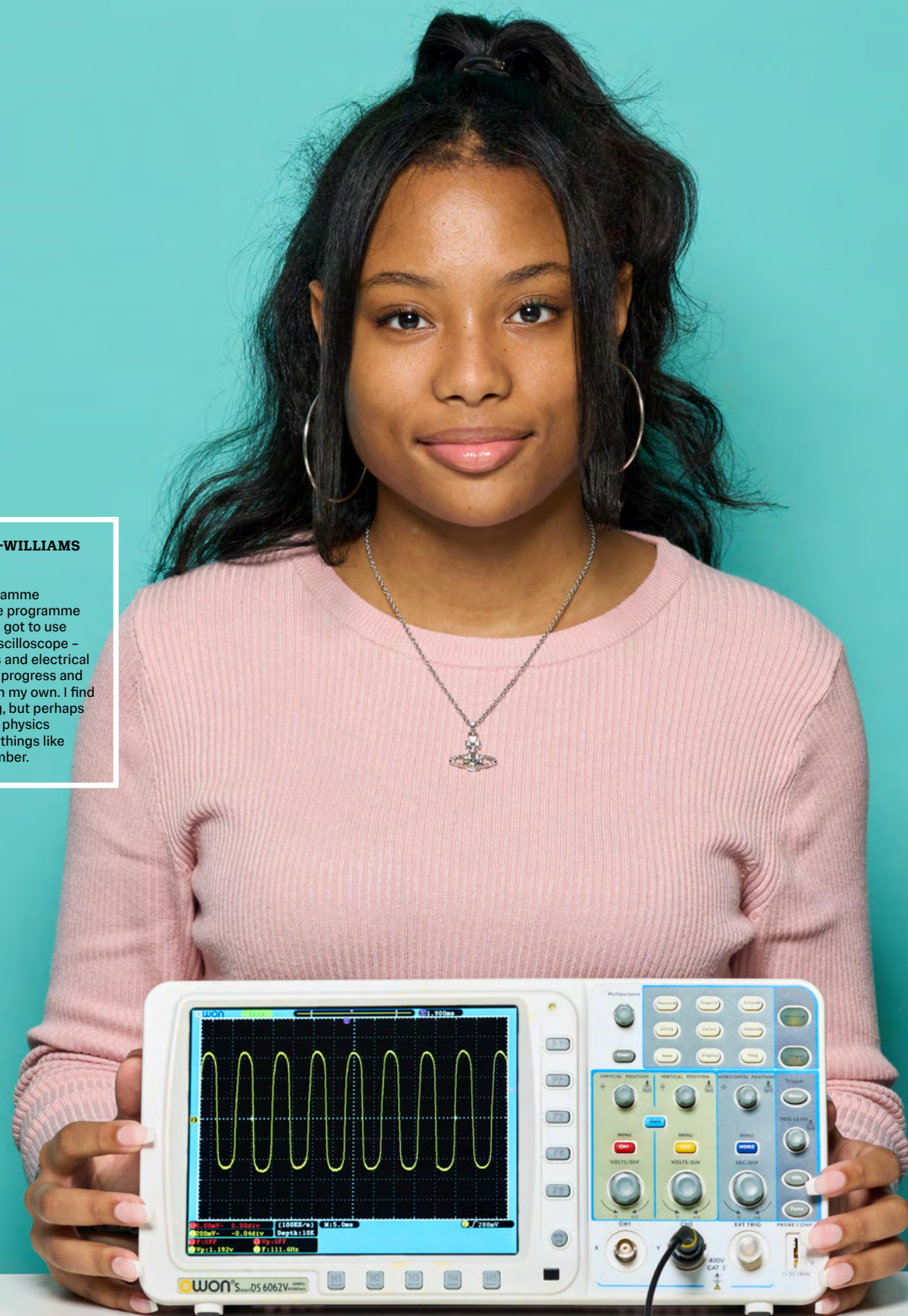
STEM Potential programme

**What’s going on:** Exploring things like titration, using this conical flask with the pink liquid, is just one of the great experiments that were so much fun at the chemistry workshops during STEM Potential. I learnt a lot as I extended my love of chemistry, and it helped me decide that I wanted to apply to study chemistry at university.

**ALISHA DESHONG-WILLIAMS****Age:** 17**Attends:**

STEM Potential programme

**What's going on:** The programme was the first chance I got to use equipment like this oscilloscope – which displays waves and electrical signals and how they progress and change over time – on my own. I find it all really fascinating, but perhaps my favourites are the physics practicals, especially things like creating a cloud chamber.



would understand,” he says. “It was tough, but I felt I could connect with them because I had been in their shoes. I wouldn’t have traditionally gone to university but the Pimlico Connection changed that, and I wanted to show them what was possible while teaching them about science.”

Another student ambassador who found outreach to be a life-changing experience is Dr Claire Doyle (Chemistry 2007; PhD Organic Synthesis 2011), who became a secondary school teacher – partly because outreach made her realise how much she enjoyed standing in front of a classroom. Her outreach career began when she visited primary schools through the Pimlico Connection. She began working at the summer schools as a chemistry mentor and, after completing a PhD, started working full time in outreach as an activities coordinator, gaining more of an insight into the students who are invited to take part from the thousands that apply.

“We looked at students from certain areas and backgrounds, below a certain income and with no family experience of university,” she says. “We met students with great ambitions and a natural aptitude for science, but who didn’t always know what to do with it. Even over the course of a five-day summer school you’d see them transform. By the end, they had developed real confidence and pride in what they were doing.”

Today, Doyle uses some of the experiments and techniques she developed in outreach at her secondary school. She also notes the importance of practical work in inspiring students, something that was the founding principle behind the establishment of the Reach Out Lab, and then the Makerspace, which opened in 2017.

As well as two summer programmes, both for 20 students and lasting a fortnight, the Makerspace holds weekly sessions during term time. In every case, students aged 14 to 18 take part in the Maker Challenge, charged with using the materials and equipment in the workshop to make a prototype or model of a project. Successful inventions include a ukulele for the deaf, trainers with speakers embedded in the tongue and a working robot. Graduates of the programme are then entitled to come back and use the Makerspace on Saturdays until they are 19.

Kate Mulcahy, Makerspace Programmes Manager, explains that it was developed as a place for students to combine engineering with design and creativity. “The Makerspace enables young people from all backgrounds in the local community to nurture talent they might not have otherwise known they had,” she says. “It offers students an insight into the power of design and engineering.

“The goal isn’t to get more students to apply to Imperial, it’s to unlock potential in young people that might go beyond the traditional academic route.

**The goal isn’t to get more students to apply to Imperial, but to unlock potential in young people that goes beyond the traditional academic route**

Science, innovation and imagination are intrinsically linked, and the Makerspace allows the next generation in the White City community to be part of the innovative environment being forged on their doorstep.”

The Makerspace team have started to take their skills and equipment to local schools, while the team introduced careers support to give students help with CVs, work experience and apprenticeship applications. While the intention of the programme is not to support them into Imperial, the team are seeing an increasing number successfully apply to Imperial.

Lord Winston thinks Outreach at Imperial does more than just broaden a school student’s scientific knowledge. “We provide awareness of the importance of science in today’s world, making a big difference to people’s lives,” he says. “We recognise that scientific endeavour is part of human values and advances humanity.

“We do more than simply teach science; we show how it improves human health and happiness and connects with the arts and other disciplines. What Outreach and the Reach Out lab do is inspirational. These activities not only help young people to communicate their science and its importance, but increase their ambition and aspirations.” ♦

> *Imperial is celebrating 50 years of providing innovative schools outreach programmes with a special Outreach at 50 series. Discover the stories of other inspiring people who have been impacted by our work at [imperial.ac.uk/be-inspired/schools-outreach/outreach-at-50](https://imperial.ac.uk/be-inspired/schools-outreach/outreach-at-50)*

**BIG! BIG! BIG!**

# QUANTUM

**DEFINED AS THE SMALLEST AMOUNT OF SOMETHING THAT A THING CAN POSSESS, THE POTENTIAL OF QUANTUM IS ANYTHING BUT SMALL. IT'S VAST, AND IMPERIAL IS SETTING THE RULES.**

Words: **Mark Frary** / Illustration: **Pâté**

**According to some unnecessarily gloomy reports**, this year marks the setting in of a quantum winter – the point at which investors officially give up on making a usable quantum computer. And you can see their point. The best quantum computers we have today can do something in the order of 100 operations before failing – usually as a result of ‘noise’ such as heat, electronic signals or magnetic fields – and that’s when they are operated in a cryogenic chamber kept close to the absolute zero of temperature.

But as the researchers at the Centre for Quantum Engineering, Science and Technology (QuEST) point out, the potential of quantum technologies is... epic. Indeed so epic that most governments are far more worried about who will get to a quantum age first than how long it will take to get there.

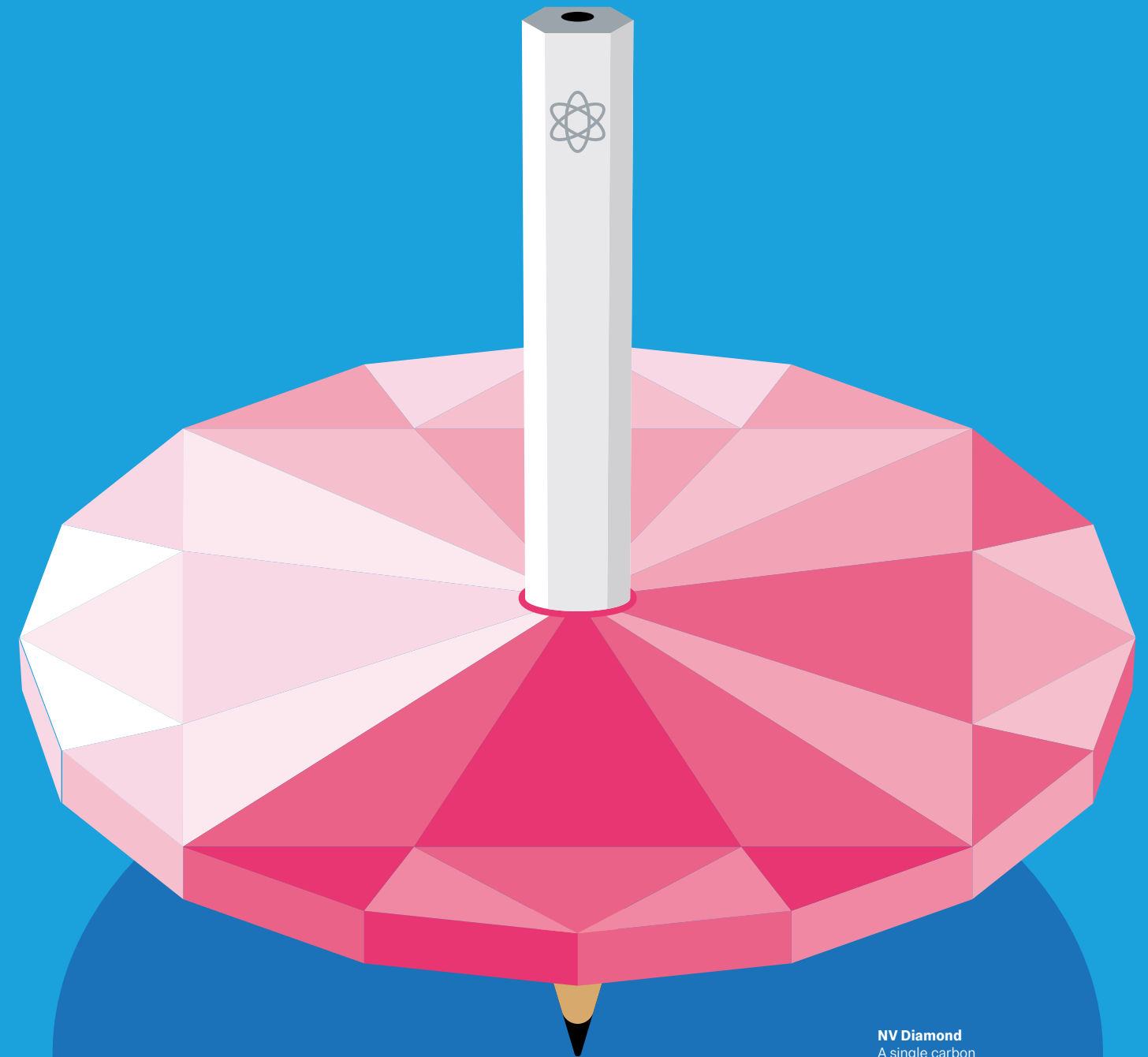
The reality is that quantum computing has the potential to revolutionise heavily demanding information processing in science and industry. It offers the tantalising prospect of near-unlimited processing capability, harnessing the power of quantum bits, or qubits. For, unlike the bits of classical computers, the power of a quantum computer grows exponentially with the number of qubits.

“Quantum computers aren’t any good for general purpose tasks; you can’t run Microsoft Excel on a quantum computer, for example,” says Professor Peter Haynes, Director of QuEST. “Yet they should be outstanding at some specific tasks that classical computers find extraordinarily difficult to do, such as the travelling salesman problem [the classic optimisation challenge in computer science that seeks to find the shortest possible route that visits every point in a set of locations just once].”

But quantum computers face a problem – they are billions of times more prone to errors than their classical counterparts, due to sensitivity to noise from their environment and small fluctuations in their operating conditions.

To address this problem, Professor Myungshik Kim’s current area of research focuses on the development of quantum algorithms for error correction and mitigation. “These fundamental and technical errors must be removed completely for a quantum computer to be useful for computation in finance, in weather forecasting or drug design,” he says. “I’m optimistic we will solve the problem.”

QuEST’s work on molecules may also help in the development of error-resistant quantum computers, says Dr Jessica Wade, Lecturer in Functional Materials. “Molecules give you protection against lots of those challenges because they can demonstrate tunable quantum phenomena at room temperature, and quantum information can be encoded onto their excited states,” she says. ▶



**NV Diamond**  
A single carbon atom adjacent to a vacancy in the diamond lattice is replaced by nitrogen, allowing the spin direction to be nudged into one direction or the other using radiation.



**If it all sounds theoretical, there are many other practical applications of quantum that could change our world**

“Using molecules lowers the cost and the environmental impact. They are inherently scalable, because every time you make a molecule, they are exactly the same as all the others.”

Quantum computers may have garnered all the headlines but if it all sounds impossibly theoretical, there are many other practical applications of quantum technologies that have the potential to change our world. And QuEST is well placed to ride this wave(-particle) of innovation.

“It’s becoming very important to make sure that quantum technologies are delivered to the market,” says Kim. Haynes adds: “Most engineers may not consider themselves to be experts in quantum, but it turns out they have lots of relevant expertise. Imperial, with its strength in science and engineering, is well placed to bring those things together.”

Take Dr Joseph Cotter’s work on quantum navigation, which offers a tantalising view of what can be achieved through leveraging quantum technologies. Most of us take for granted being able to find out exactly where we are, thanks to GPS. Yet for many applications, using GPS is either impossible or not permitted for security and safety reasons.

“These days, we are incredibly dependent on GPS positioning,” says Cotter, an EPSRC Quantum Technology Fellow. “Yet GPS doesn’t work underground or underwater and it is easy to spoof.” So Cotter’s team is developing a new quantum sensor, an innovative type of accelerometer which measures how an object’s speed changes over time. By combining this information with rotation measurements and the initial position of the object, the current location can be calculated.

Conventional accelerometers are used in many devices, including mobile phones and laptops, but these sensors cannot maintain their accuracy over longer periods of time without external reference. The quantum accelerometer uses ultra-cold atoms of rubidium-87 to make highly accurate measurements. This approach reduces or eliminates the ‘drift’ so common to traditional positioning systems, where a device cannot accurately determine or track an object’s position over long periods of time.

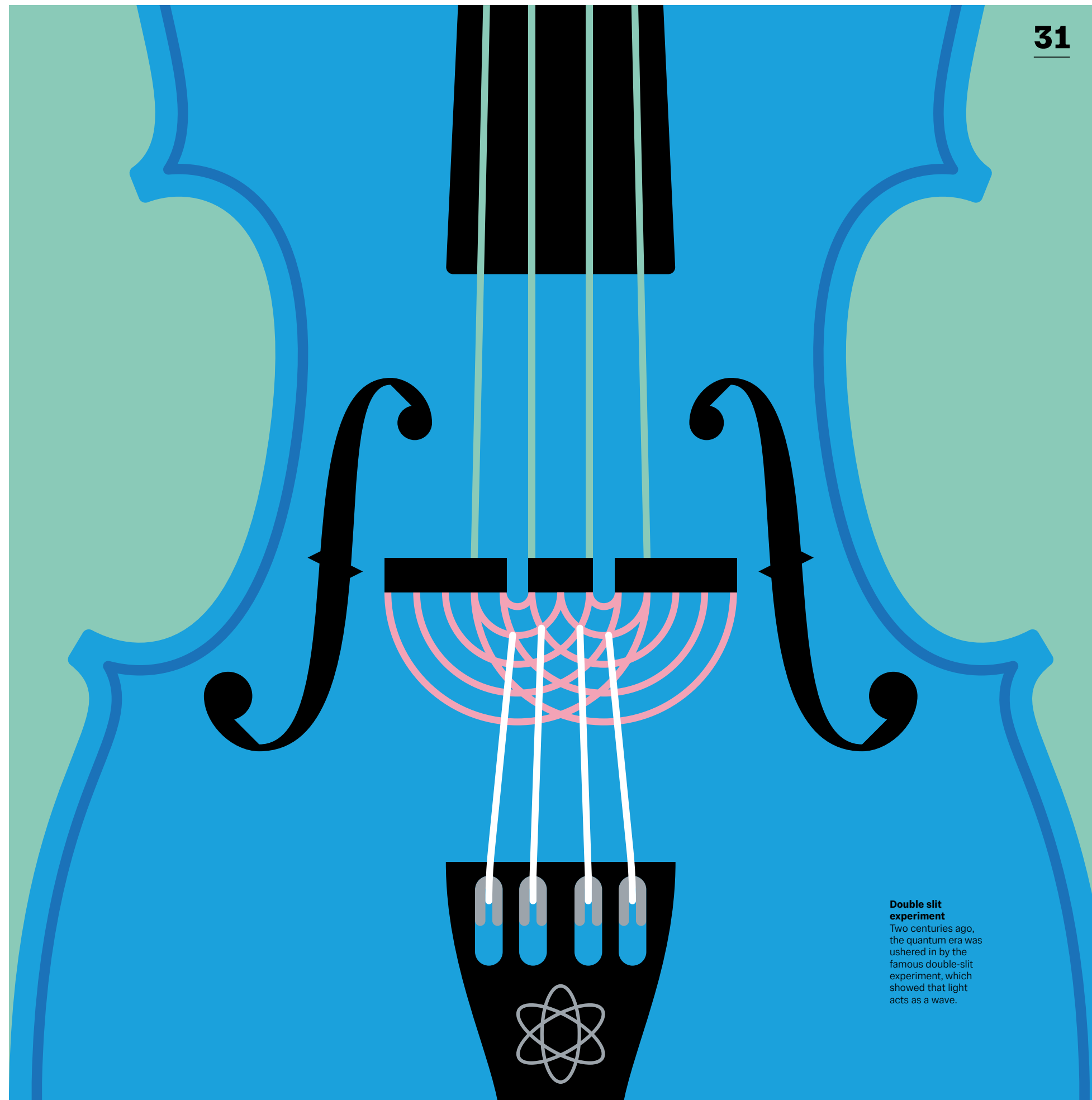
One application of Cotter’s work is a proof-of-concept for locating Tube trains on the London Underground. Cotter’s team has managed to condense a table full of lasers and two giant racks of electronics at Imperial’s Blackett Laboratory into a washing machine-sized box that can fit on board. The team has also carried out trials of the system with the Royal Navy, exploring ways to make ships’ navigation systems less susceptible to jamming, imitation or other sabotage.

**Like all technologies,** new quantum devices rely critically upon materials, both at the heart of the quantum system and also in the surrounding infrastructure. That’s where Professor Sandrine Heutz’s work on the quantum properties of carefully chosen molecular systems comes in.

Their usefulness comes from a property of electrons known as spin, a measure of their intrinsic angular momentum. This spin can be characterised as being either up or down. “Those spins can be used as quantum bits of information,” says Heutz. This is analogous to the zeroes and ones of digital computing. The exciting part is that this spin state can be both controlled and measured by external triggers, such as electric and magnetic fields.

One such material is NV diamond, where a single carbon atom adjacent to a vacancy in the diamond lattice is replaced by nitrogen. As well as giving the diamond a characteristic hue, it also allows the spin direction to be nudged into one direction or the other using radiation.

Imperial’s state-of-the-art fabrication and characterisation facilities, including cryo-electron and scanning probe microscopies, is particularly useful to combine materials and enhance quantum properties. “The study of interfaces between materials opens up avenues to create new functionalities,” says Heutz. “It is also crucial in the development of optimised quantum devices and to combine the benefits of mature and emerging materials platforms.” ▶



#### Double slit experiment

Two centuries ago, the quantum era was ushered in by the famous double-slit experiment, which showed that light acts as a wave.

# Your gift set me up for life

When Engineering student, Tristan, struggled with his mental health, he was able to focus on his studies and succeed thanks to the generosity of our kind Imperial supporters, like you.

Reaching Imperial was a dream come true for Tristan. Having grown up in a small Midlands town, he was excited to experience life in the capital city whilst pursuing his passion for engineering. But as his degree progressed, the pressure of his studies began to mount and he found it increasingly hard to cope.

The demanding days and intensity of his degree, coupled with the rising costs of living in London, put a huge strain on Tristan. He began to question if he could continue at Imperial whilst he clung on to everything he'd worked so hard to achieve. It felt like his future was at stake.

## Your generosity kept Tristan on track

Kind Imperial donors, like you, supported Tristan through his toughest days. By funding his scholarship, his money worries were taken away, freeing him to focus on his studies and make time to address his emotional needs.

"My scholarship meant I didn't have to hunt for a part-time job when I already felt anxious and stressed," he says. "Having that financial security allowed me to unwind, meet up with friends and exercise — which all played a huge role in my recovery."

## A future built on your support

With your generosity, Tristan overcame his mental health struggles, completed his degree, and is now working as an actuarial analyst at Deloitte. He attributes his success to the experience he had at Imperial and your support.



**I'm so grateful to the alumni and friends who helped me overcome my struggles. They eased my worries, made me more resilient, and set me up for the future.**

"It may not always be obvious, but a donor's gift is truly life changing. My scholarship helped me to make the most of my time at Imperial, which is an amazing foundation for the rest of my life. I feel proud to be part of such an amazing community and I've no doubt that alumni support means just as much to other students as it does to me."

## Will you help more students like Tristan?

No one knows the life-changing impact of an Imperial education better than the Imperial community.

Your support can ease students' financial worries and give them the means to thrive, whatever hardship they face. If you would like to support more students like Tristan, please give a gift using the form enclosed or online:

[imperial.ac.uk/giving/winter-magazine-24](https://imperial.ac.uk/giving/winter-magazine-24)



**Professor Peter Haynes**  
Professor of Theory and Simulation of Materials.



**Professor Myungshik Kim**  
Chair, Theoretical Quantum Information Sciences.



**Professor Riccardo Sapienza**  
Professor of Physics.



**Dr Joseph Cotter**  
Senior Research Fellow, Faculty of Natural Sciences.

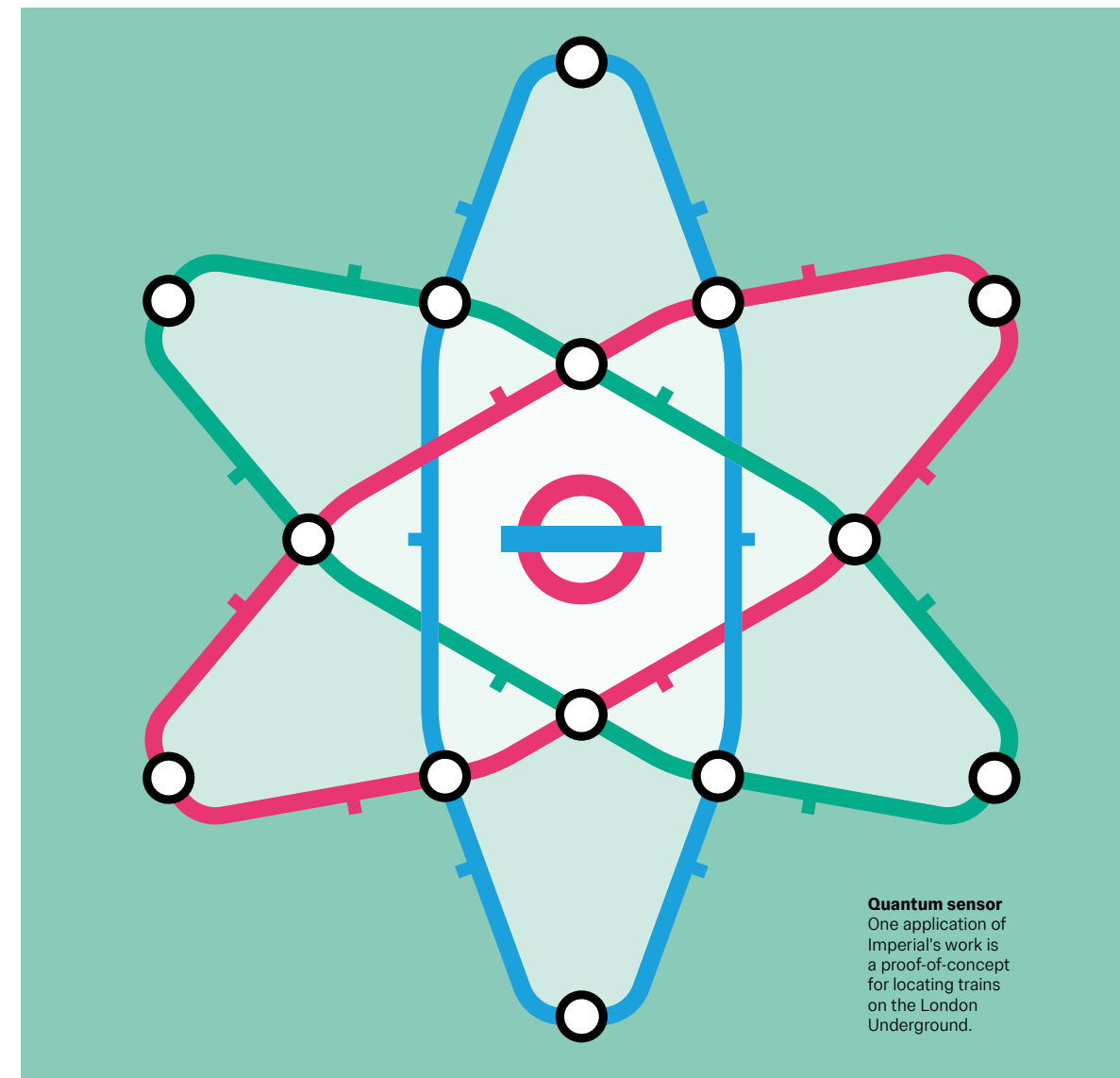


**Professor Sandrine Heutz**  
Head of the Department of Materials.



**Dr Jessica Wade**  
Lecturer in Functional Materials.

PHOTOS: THOMAS ANGUS, DAVE GUTTRIDGE



**Quantum sensor**  
One application of Imperial's work is a proof-of-concept for locating trains on the London Underground.

Meanwhile, QuEST's Professor Riccardo Sapienza specialises in nanophotonics, the science of controlling light in matter at the nanometre scale that has been subtly altered by adding particles or drilling holes. "These metamaterials have new properties that depend on the way we structure them," says Sapienza. "In this way we can enhance light and matter interaction, similarly to a violin boosting the sound waves it emits."

Two centuries ago, the quantum era was ushered in by the famous double-slit experiment, which showed that light acts as a wave. (Further experiments, however, showed that light actually behaves as both a wave and as particles — revealing its quantum nature.) Now one of Sapienza's most exciting projects has identified metamaterials which reveal a similar effect not just in space but also in time.

"With these we have shown a temporal double-slit interference effect, where a photon is reflected at different times, and the light detected is the interference of these two reflections, one in the past and one in the future," says Sapienza. Such 'time-varying metamaterials' could have several applications, including very fast optical switches for signal processing and communication or reconfigurable components for optical computing.

It's more than a century since scientists such as Planck, Heisenberg and Schrödinger introduced us to the weird world of quantum mechanics, a world in which things can be both particles and waves, where objects no longer exist in precisely defined locations and where cats can be alive and dead at the same time. Since then, quantum mechanics has become one of the most tested and trusted theories in history. Now the race is on among scientists, engineers, technologists, companies and governments to harness the power across the range of quantum technologies. ♦

The Imperial Sinfonietta has been hitting all the right notes for 25 years – on and off stage. So just what does it take to be part of this select group of musicians?

Words: **Megan Welford** / Photography: **Dan Burn-Forti**

# A HIGH BAR

As the conductor's steely gaze scans across the orchestra, each member shifts nervously in their seat. Despite the fact that it's been many years since they played together, the old feelings of anxious exhilaration flood through them. On clarinet, Chris Woodroofe (MEng Chemical Engineering 2000), holds his breath. "Even though I graduated years ago and I'm now the managing director of Manchester Airport, I felt just like a nervous student again," says Woodroofe. "Dan has that way of hearing everything – he can still look at me and I think 'Oh God!'"

'Dan' is distinguished New York City Ballet (among others) conductor Daniel Capps (Physics and Music 1999), the founder of Imperial College Sinfonietta who is returning for a one-off reunion concert. But back in 1996, Capps was in his second year at Imperial, studying the music part of his degree at the Royal College of Music. "Imperial's part-time musician-in-residence, Richard Dickins, was conducting Imperial's Symphony Orchestra (SO), and said there were too many students so I should start another orchestra," remembers Capps. "Though he did point out that it had been tried twice – and had failed twice."

Only slightly daunted, Capps decided to give it a go. "I had been playing flute in orchestras my whole life, so I had an idea about what worked and what didn't. I just wanted it to be functional and satisfying. It was a lot of fun and quickly became popular – we had strings out the door. At the start, I put out all the chairs and did all the posters." Woodroofe remembers how impressed he was at the very first rehearsal. "Our first rehearsal didn't ►

**From the left**  
Misaki Inoue (Biochemistry 2024), violin; David Silcock (Biomedical Engineering, Fourth year), French Horn; Alexander Gavrishev (Physics, Fourth year), clarinet; Bryony Lanigan (PhD Physics, Third year), double bass; Thomas Fitchie (Computing 2024), violin; Emma Horgan (Physics, Fourth year), oboe; Muzi Li (PhD Civil Engineering, Second year), violin.



feel like a first. Dan was just an undergrad like me, but it felt like he'd been conducting for years."

Not that it was all plain sailing. "We had booked our first concert during the lunch hour," says Capps, "which meant we couldn't rehearse before. We had a very small window to tune up before the audience came in, and everyone was there apart from the bass trombone player. There's only one bass trombone, and there were no mobiles back then, so I was quite anxious. He rocked up with 30 seconds to spare and said, 'Sorry, I was playing pool and the balls just weren't going in.' I could have killed him!"

By its second year of existence, Sinfonietta had a budget of £100 a year. "We were printing posters and paying for music – our costs were gradually increasing," says Capps. "We moved to termly, evening concerts we could charge for, and it was becoming clear that, rather than being a side gig of the SO, we needed to form our own society, and ask for some of the university grant. It was quite awkward, but I realised that if it was to have a future, Sinfonietta needed to become its own thing."

"I remember going to Dan's house to figure out how to organise ourselves," says Woodroffe, Sinfonietta's first ever chair. "We basically stole SO's constitution and cribbed it. It was a new world for us, with a treasurer and a chair. We had to figure out how the things that Dan made happen magically actually got done, so we could do them instead of Dan, so he could be free to conduct."

"At our second ever committee meeting I said I thought we should go on tour, and they all just laughed at me!" says Capps. "But I had gone on tours as a child and made so many friends and had so many adventures, and I wanted the same here."

The following year's trip to Paris would be the start of a yearly Sinfonietta tour, pandemic years excepted, all with their own share of adventures. "We went to Vienna and Bratislava one year," remembers Capps. "We were going to play Bruckner's *No 7* inside the Karlskirche, where his funeral took place. We were rehearsing, all set to go, and then at 11pm the night before, the chair got a call from an American lady who was bringing a youth choir on tour, and had seen our concert advertised at the same time and place as theirs was scheduled. They were going to do Mozart's *Requiem*, accompanied by an organ. I said: 'Look, we'll give you our orchestra for the *Requiem*, and

from then on, we flew with our instruments. We have to book the cellos their own seat!"

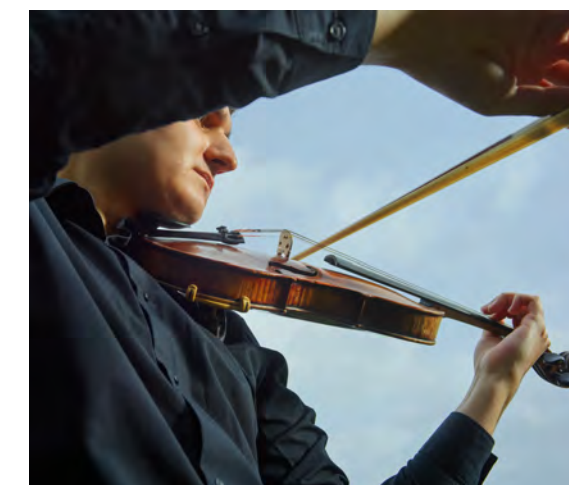
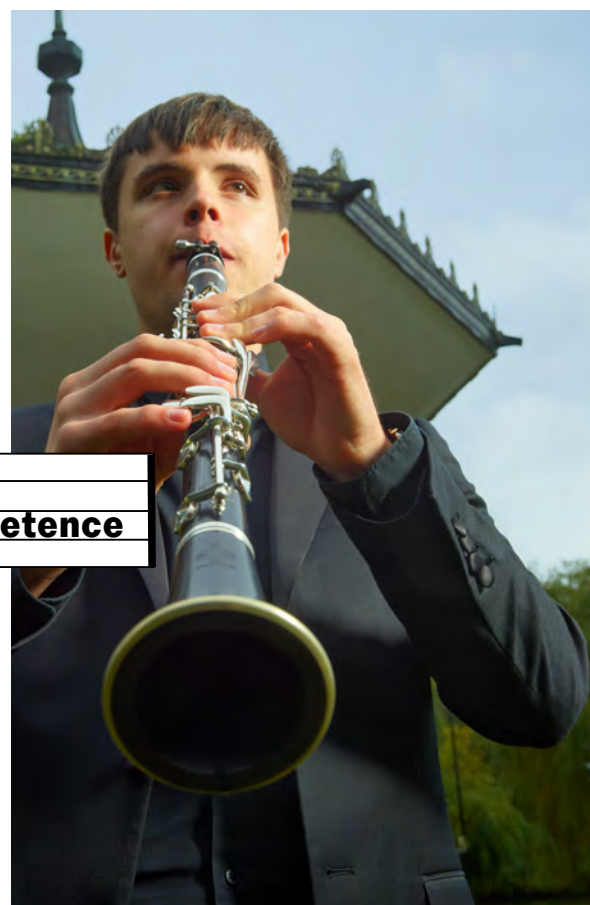
Sinfonietta members rehearse every Monday night for two and a half hours and hold three concerts a year. "Everyone is in Sinfo because they just love to play," says current Chair Bryony Lanigan (PhD Physics 2026). "There's no room for superiority or oneupmanship, there's no pretence. People are here because they want to have fun and play music. They tend to start in their first year and stay for their whole time at Imperial. Students here are generally high-achieving, many have played music to a high level since they were young. But when we interviewed recently for what's only our third ever conductor, we were looking not only for someone competent, but someone cheery, capable of lifting everyone up."

"It's a group who are not professional, not Royal College, but really talented players who put the effort in and hold up their end of the bargain," says Woodroffe. "And it sounds wonderful. It's such a privilege to play an instrument, and incredibly valuable. Sinfonietta let me in when I wasn't sure I was good enough, and without it I'm not sure I'd still be playing. My proudest moment was coming back in June to play the reunion concert. I felt like I'd never been away."

Emily Strachan (Life Sciences 2019; PhD Clinical Sciences 2023) was Chair from 2020 to 2021, and says some of her favourite concerts have been supporting a soloist in a violin or piano concerto. "That feeling of the orchestra coming together in the concert, being part of a much bigger sound than you could ever make by yourself. I enjoy rehearsals as much, though, when you're trying to work out what's going on around you, noticing all the different textures, and then it all coming together, probably a bit too late in the term for the conductor's stress levels!"

"There's a resonance of connectedness," agrees Lanigan. "When you're on the same page, moving to the same beat. You even breathe together – you breathe in and then out to begin. A PhD can be very tense and stressful, and you're often shut away in a lab on your own. My lab is in the basement, so I am literally resurfacing to come and play in the orchestra. Science and maths are a particular kind of difficult: physics, for

> *Were you part of the music scene at Imperial? Tell us about it at [imperialmagazine@imperial.co.uk](mailto:imperialmagazine@imperial.co.uk)*



**There's no room for superiority or oneupmanship, there's no pretence**

we'll do the Bruckner in the second half.' We didn't have parts for Mozart, but we managed to borrow them off the Vienna Philharmonic, and we learnt it in an afternoon. It was a great success! The choir was thrilled.

"Another time, we sent a van of instruments off to Stockholm, while we flew. But there was an accident on the M13 and the van missed the ferry, and there wasn't another for three days. Our secretary, who was my housemate, spent six or seven hours trying to reroute the van overland with a series of tiny ferries – it was before they built the bridge. The van just made it, but

example, has an aggressive amount of hours, and it's good to have friends outside of that."

Monday rehearsals are usually followed by the pub. "I have made my best friends here," says Lanigan. "At rehearsal, in concerts and on tour." And Capps agrees that friendships made are often held for life. "I still have so many friends from Sinfonietta," he says. "I've been to four weddings; our first secretary is coming to stay this weekend. Playing together is an emotional experience, a release from stress. I'm delighted it's still thriving, and I hope it lives on for a long time to come." ♦

# IMPERIAL

## GLOBAL SUMMER SCHOOL

# A global summer like no other

Global Summer School provides a full Imperial experience. From 30 June – 11 July or 4 August – 15 August, elevate your passion for STEM and make friends from around the world. Take practical lessons, solve real-world challenges, and access Imperial academics, mentors and facilities, all from our Central London campus.

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# IMPERIAL



## Imperial Lates

Lates are fun and social post-work events where visitors can interact with the latest scientific developments at Imperial, centred around a new theme for each evening

The new season begins in December, exploring the following themes:  
Senses: 5 December 2024  
Weird Science: 6 February 2025  
Future Cities: 6 March 2025 TBC



Imperial College London

[imperial.ac.uk/be-inspired/lates](https://imperial.ac.uk/be-inspired/lates)

DATASET – NICK FRANKS, PROFESSOR OF BIOPHYSICS AND ANAESTHETICS, AND PROFESSOR BILL WISDEN, CHAIR IN MOLECULAR NEUROSCIENCE

## Sleep is the brain's way of tidying up, right? Actually... wrong.



**Context** How does sleep actually work? We know it's essential – protecting physical and mental health, benefiting the heart, boosting the immune system and consolidating memories – but understanding exactly how it works has proved problematic. We do know that sleep recharges us and that without it, we suffer. And scientists have also long believed that fundamental to all this cranial housekeeping is that when we sleep, our brain clears itself of toxins. But two Imperial researchers have surprisingly discovered... it doesn't.

**Background** While the exact biological purpose of sleep has eluded scientists, received wisdom for the past ten years has subscribed to a theory known as the 'washing machine hypothesis' – that the sleeping brain flushes out toxins and metabolites such as amyloid-beta to prevent an excessive build-up that can result in Alzheimer's disease.

But Nick Franks, Professor of Biophysics and Anaesthetics, and Professor Bill Wisden, Chair in Molecular Neuroscience and interim director of the UK Dementia Research Institute, were sceptical. "The idea that the brain would suddenly speed things up and clear toxins and metabolites during a sleep state, when we know perfectly well most things slow down, seemed intriguing," says Franks. "We decided to put it to the test."

**Methodology** Previous research involved injecting a tracer (a fluorescent dye) into the cerebral spinal fluid that surrounds the brain and seeing how quickly it moved into the brain. But, says Franks, the scientists wrongly assumed that this automatically showed them how much fluid – toxins, for example – moved out. "The problem was

that only a fraction of the tracer injected into the cerebral spinal fluid actually entered the brain – so assuming that this was a good surrogate for how much leaves the brain was unconvincing."

For their experiment, instead of injecting dye into the fluid, Franks and Wisden injected dye directly into brain tissue. Three hours later, they measured how much was still there, and how much had moved to other parts of the brain.

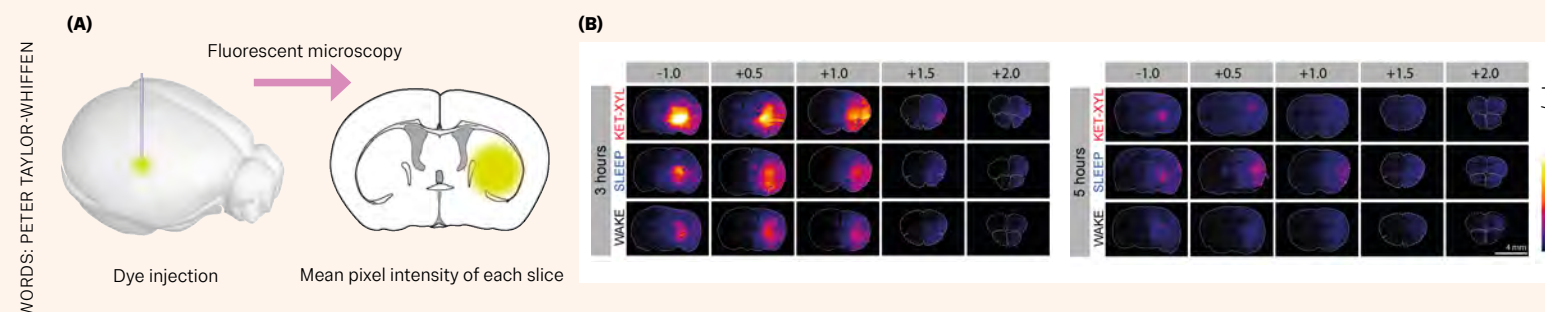
**Results** The pair were shocked by the new measurements. "Contrary to previous studies, we found that less toxin and metabolite was cleared during sleep, not more," says Franks. "Around 30 per cent less in sleeping mice and 50 per cent less in mice under anaesthetic." And the activity accelerated when the mice began to wake up. "The toxins cleared in a waking state, not a sleeping state," he added. "That makes sense and if this study had been the first, I don't think anyone would have been surprised. Our initial assumption was that we must have made a mistake, but after months of checking, we believe we haven't."

**Outcome** The results will leave the field having to re-evaluate its theories on why we sleep and may bring closer an understanding of the link between sleep and dementia – something the pair will continue to explore in subsequent research. "Disrupted sleep is commonly experienced by people living with dementia, although we don't know if this is a driver of the condition or a consequence of having it," says Wisden. "It may turn out that having good sleep does help reduce dementia for reasons other than clearing toxins." ♦

> *To find out more, visit: [franks-wisden-lab.org](https://franks-wisden-lab.org)*

### THE EFFECTS OF SLEEP ON BRAIN CLEARANCE

By studying (A) the average fluorescent intensity of an injected dye across brain slices and (B) the concentration for three states of vigilance (wake, sleep and KET-XYL anaesthesia), Franks and Wisden concluded that brain clearance is reduced during sleep and anaesthesia, challenging the idea that the core function of sleep is to clear toxins from the brain.



**Professor Gary Hampson** on a field trip in Arches National Park, Utah, USA.

**Guiding students through description of fossiliferous sandstones** as part of an introductory field trip in Almería, Spain.



**Teaching fluid flow** through heterogeneous sandstones in front of Bridport Sands cliffs, Dorset.



**Students observing and describing sandstones and mudstones** offset by a fault in Exmouth, Devon.

#### ADVENTURES IN... FIELD TRIPS

## Getting a field for it

When it comes to learning, there's no substitute for experiencing the real thing, says keen explorer Professor Gary Hampson.

Words: **Kat Brown**

**P**rofessor Gary Hampson has been keen on expeditions for as long as he can remember. As a child, fascinated by history and science, he spent family holidays organising his own trips. "I clearly remember dragging my parents and my brother around Hadrian's Wall," he says. "I was really into the Romans too."

However, his first official field trip, at 18, was to the Isle of Arran, off Scotland's west coast. "It was lovely," he says, "although the weather was absolutely terrible. We had a week of horizontal rain." But despite the wet, the trip made a lasting impression. "Field trips are essential in my view. Things that can seem fairly dry and abstract in a lecture theatre come to life because in the field you have an example right there in front of you."

Hampson has seen this for himself on an epic scale in Utah, a place he has explored repeatedly over his career, firstly as a PhD student, and subsequently in his own work. "It's an amazing place in terms of the landscapes. I wouldn't claim to be a hardcore explorer, but it's easy to imagine that you are when you're in a landscape like that. The people you're with might be the only ones you see that day. You go to some places and the cliffs are hundreds of metres high. You can literally trace things out for tens of kilometres. You really get to things at a scale that is almost unimaginably huge."

Having the capacity to appreciate work on a micro as well as macro level helps Hampson to remain grounded. When he became Director of Undergraduate Studies last year, he started

taking a broader range of students on field trips. As well as undergraduates, this has included Master's students, often from an engineering background, who are coming to geology cold. "They ask questions and make observations that they might think are stupid or basic, but they're really fundamental," he says. "They challenge you to explore some of your own assumptions."

In recent years, the expense of field trips has become a live issue for the Geology department and has proved to be a barrier to entry for some of its students. "You do need to be well equipped for the field, otherwise it can be a pretty miserable experience," he says. "Over the years, we've become a bit more aware of the barriers." Now the Department offers bursaries for equipment, field trip costs, accommodation and food so that every student can enjoy the opportunity to explore their subject in a live setting.

While Hampson drily observes that trips to Spain or to the Appenines in Italy are "an easier sell" than those in the UK, any outing provides a valuable connection between students and their subject. "While the UK maybe doesn't sound so attractive, they are seeing things in the landscape they hadn't appreciated might be there before," he says. "It can be truly transformative." ♦

> *The Dean's Fund creates new opportunities that kindle scientific curiosity, spark groundbreaking research and support the scientific leaders of tomorrow. To support its work and enable more students to undertake field trips, visit [bit.ly/57-fons-deans-fund](http://bit.ly/57-fons-deans-fund)*

PHOTOS: LIDIA LONERGAN, GARY HAMPSON, XINYU DONG, EMMA PASSMORE

POLICY AGENDA – DR LESLEY DRAKE, EXECUTIVE DIRECTOR,  
PARTNERSHIP FOR CHILD DEVELOPMENT, SCHOOL OF PUBLIC HEALTH

## How research evidence helped to feed Nigeria's children



It's not every day you get a call from one of Nigeria's leading politicians asking you to help feed his country's children. But for Dr Lesley Drake (PhD Biology 1992), Executive

Director of Imperial's Partnership for Child Development (PCD), that call was the natural consequence of her team's extraordinary work.

The PCD has gained an impressive reputation over the past 30 years, working with governments, agencies and communities to improve the education of school-age children in low and middle-income countries. So when Rauf Aregbesola, Governor of Nigeria's Osun state and the nation's Vice President at the time, wanted to roll out a successful Homegrown School Feeding programme that would give daily school meals to ten million of the country's youngsters, his first call was to Drake.

"There are 36 states in Nigeria, 13 of which had school feeding programmes, but they all just crumbled – except for the one in Osun state," she says. "The PCD had worked across the world, and particularly Africa, providing research evidence that supported initiatives to improve children's health and wellbeing. So Mr Aregbesola came to us to help understand why the schemes collapsed and how to expand the programme."

Drake and her PCD colleagues – in partnership with the Global School Meals Coalition Research Consortium – first performed a situation analysis to see what made Osun's programme work, and then compared it with those of other states. The PCD's analysis of different programmes in various state contexts highlighted the trade-offs between cost, programme design and successful service delivery.

"At the time Osun was feeding about a million children – but it was haphazard. So we made it more systematic and accountable. The strengthened model was then adapted to, and adopted by, the other states around Nigeria."

It was a challenge, she says. "Nigeria is an interesting place, with different ways of working and a vulnerability to corruption." When money for the programme left the federal fund it passed through lots of hands, with much of it "disappearing" before

reaching the schools and children who would benefit. "We turned it into a cashless operation, which immediately shored up some of the money," says Drake. "It also made everything very transparent. You could track that the money was getting to the right places."

As a result, the number of children receiving a daily school meal soared from one million to ten million – a sixth of all children currently in school feeding programmes in sub-Saharan Africa – in just four years, prompting a pledge from Nigerian president Bola Tinubu to double the number of beneficiaries to 20 million by 2025 with the PCD's help.

"It's great that President Tinubu is such a keen supporter of the programme," says Drake. "That is a huge factor in making the programme work. School feeding is multi-sectoral. It's about health, education, agriculture and social factors, so you can imagine it's really difficult for those sectors to work together because they don't want to spend their own budgets on other sectors. But making this a President's fund, through which each sector has to develop a costed and accountable implementation plan, makes it work."

Even so, the PCD still needed to help justify the cost. "The only way you can do that is through the evidence," says Drake, "so we conducted a value-for-money analysis in collaboration with Harvard University and the School Meals Research Consortium, and in line with other countries in the School Meals Coalition, to work out the costs against the benefits."

"If you can provide the research evidence as to why some state schemes work while others don't – and you can prove the value for money, the financial benefit of a project – people sign up to it and are happy to prioritise spending on that rather than something else," she adds. "Analysis shows that for every dollar spent on school feeding, the economy can get seven dollars back. It's a clear example of research laying the foundation to enact real world change. By engaging with policymakers we've helped to shape a programme that will enhance the futures of millions of young people." ♦

**As a result, the number of children receiving a daily school meal soared from one million to ten million**

WORDS: PETER TAYLOR-WHIFFEN

ALUMNI LIFE

## Connecting with our global community

Don't miss your chance to hear the very latest research and insight direct from Imperial people.



Imperial is proud to be a truly global university: last year, we welcomed more than 140 nationalities to campus. But along with bringing the world to Imperial, the university is also bringing Imperial to the world, with three new Imperial Global hubs launching in Singapore, the US and Ghana by the end of this year.

It's the perfect example of Imperial connecting alumni around the world – strengthening local networks, engaging alumni with key emerging themes and helping Imperial to address the big challenges.

For instance, as part of a Venture Trek series run by the Enterprise Lab, Imperial founders have been pitching their innovative ideas to a global audience of alumni, industry experts and investors, delivering content-driven, location-focused events that offer an amazing networking opportunity and the chance to be inspired by what's currently happening at Imperial.

In Singapore, the focus was on startups working at the cutting edge of AI innovation as they joined a showcase event hosted by Imperial Global Singapore in the CREATE Tower. Singapore has one of the world's leading AI ecosystems, with plans to invest more than US\$743 million into AI over the next five years, and our hub's inaugural research programme aims to undertake world-leading research and establish Singapore as a leader in health cybersecurity and AI for healthcare.

Another five alumni founders headed to New York for Climate Week, where they presented their innovative

WORDS: LUCY JOLIN

**Clockwise from top left:**  
**Accra:** Alumni and friends met in Accra, Ghana at a reception hosted by Professor Hugh Brady.  
**New York:** Clean tech startup showcase, September 2024.  
**CERN:** More than 130 graduates gathered at CERN in Geneva, Switzerland, home of the world's largest particle physics lab and the Large Hadron Collider, September 2024.  
**Singapore:** Imperial opened its first overseas research and innovation centre in Singapore in 2024.

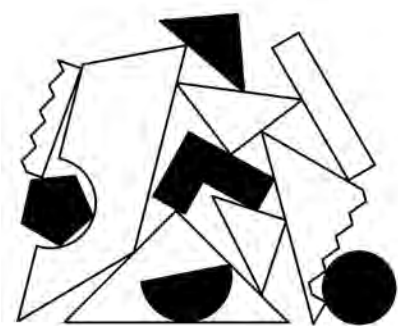
solutions for a more sustainable future to climate leaders from around the world. They were joined by representatives from Imperial's Grantham Institute for Climate Change and Environment, and Undaunted, the climate accelerator based at the White City Deep Tech Campus.

Also, this autumn, alumni and founders joined industry experts and technology innovator, entrepreneur and investor, Wendy Tan White (MEng Computing 1992) at Intrinsic to celebrate the launch of Imperial Global USA. The event featured a panel discussion on new frontiers in AI and robotics, highlighting how breakthroughs in deep science and technology are driving innovation and impact across key sectors including health, climate and advanced manufacturing.

And in Accra, ahead of the opening of the Imperial Global hub there, Imperial's Majid Ezzati, Professor of Global Environmental Health, launched CLARITY (Climate Change Resilient Equitable Healthy Cities in Africa), a new partnership with policy and societal partners that will explore how climate change affects environmental risk exposures, and who are vulnerable to these risks.

So, wherever you are in the world, it's an exciting time to be part of Imperial – and everyone's invited. ♦

> **Stay in touch:** visit [alumni/contact-us/update](#) to keep your details up to date so we can send a personal invitation to the next event near you straight to your inbox.



## PUZZLES

## Test your brain power

Imperial's top quizzers set the ultimate puzzle challenge to find out just how much you know.

**HARD** Give the link that joins: Alexandre Dumas, George V, Garibaldi, Voltaire.

**HARDER** Leonard Bernstein's series of six lectures in 1973 at Harvard was given a collective name that's also the title of a Charles Ives orchestral piece. What was it?

**FIENDISH** Only Connect wall: rearrange the wall into rows – each row has a unique common link that must also be identified.

Can can	Dik-dik	Makemake	Baden-Baden
Pango Pango	Pupu	Cha cha	Aa
Aye-aye	Four-four	Walla Walla	Mahi-mahi
Bora Bora	Dodo	Rongorongo	Yé-yé

> Find the answers on our website at: [imperial.ac.uk/be-inspired/magazine/issue-57/brain-power](https://imperial.ac.uk/be-inspired/magazine/issue-57/brain-power)

**FOR ISSUE 56 SOLUTIONS:** [imperial.ac.uk/be-inspired/magazine/issue-56/brain-power](https://imperial.ac.uk/be-inspired/magazine/issue-56/brain-power)

ILLUSTRATION: MIKE LEMANSKI



## WORKING LIFE

## The sun of many parts

Launching EasySolar dropped everything into place for Alexandre Tourre.

Interview: **Peter Taylor-Whiffen** / Photography: **Hickmatu Leigh**

**T**he essential ingredients in my career to date have come together without me really noticing, but now I realise that I wouldn't be where I am today without them. When two friends and I were thinking how we could help tackle the issue of energy access – there are still around 600 million people in the world who live in the dark when the sun sets, most of them in sub-Saharan Africa – the concept of our company, EasySolar, was no more than a 'what if', almost like a classroom project.

Indeed I've come to realise I didn't have a game plan for any of this. My degree from Imperial was in computing, I studied engineering in France, I worked as a financial advisor and went to the US to study public and international affairs. I've always learned about things that motivated me and made me passionate at the time. I acquired knowledge

**Solar so good:** Alexandre Tourre hopes his venture is changing lives.

and skills without knowing exactly what I'd use them for – but then launching EasySolar, it all dropped into place, the dots connected and everything made sense. I didn't know it back then, but all the baggage I've acquired has been essential in shaping me to do what I'm doing today.

EasySolar is tackling the issue of energy access by helping people to unlock access to solar power – currently in Sierra Leone and Liberia, but we want to expand. We distribute small solar kits that provide people with inexpensive access to power and light – so they can run things such as cookers, freezers and phones, but reduce the money they have to spend on them.

These are often people who are 'unbanked' – they don't have savings or access to financial services. Many are already spending 20 per cent of their income on energy but not efficiently or effectively – they're paying for candles or refuelling a kerosene lamp. And they are disconnected – some have phones, but charging them means giving the battery to someone who runs a motorbike taxi service to take it to the nearest town where someone else may have a diesel generator, and then hoping that the same taxi driver is able to bring it back to you by the end of the day.

### The initial concept for EasySolar was no more than a 'what if' – almost like a classroom project

For us, it's all about access, really making a difference to people's lives – and social entrepreneurship is about teaming up with others to make that happen. We got a lot of support from impact investors who, like us, are focused on making that positive difference. People who are happy to wait longer for a return, or will accept less of a return than on a commercial investment. People who think the same way we do.

Imperial brought me to this point. I have come to understand there's nowhere like it, not just for academic excellence but for the quality of how it teaches and encourages students to apply that academic excellence in the real world.

And not just the teaching, but the community. My first involvement of social entrepreneurship came at Imperial. A fellow student was starting an organisation that would become the charity FoodCycle – serving three-course meals to communities across the country – and a few of us volunteered with him.

That sowed a seed, the idea of effecting social change, seeing injustice and realising that you could make a difference. As I came to launch EasySolar, I realised that along my journey I had acquired the different skills required – innovative thinking to find solutions that had not been done before, and a strong understanding of how business works, both financially and operationally. Put that together with the strong desire to make a difference and you can completely change people's lives. That's what I hope we're doing. ♦

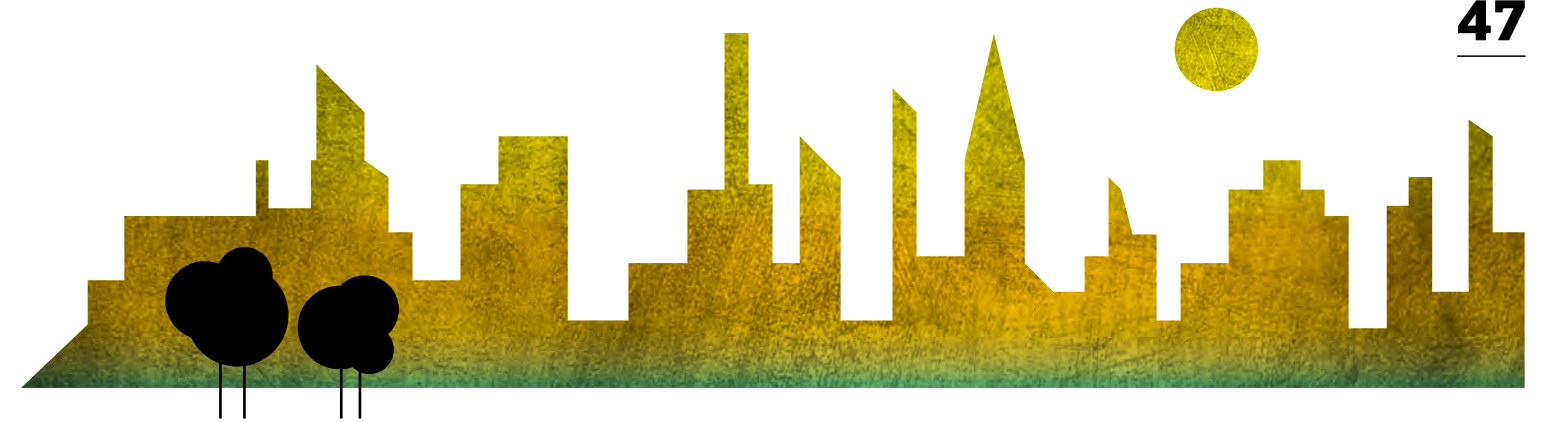
> **Alexandre Tourre** (MSc Advanced Computing 2009) is CEO of EasySolar and is winner of Imperial's Emerging Alumni Leader Award 2024.



OUR IMPERIAL

# Fit for the future

Imperial has been the perfect springboard for three specialists working to change the face of our future built environments.



## ANTOINETTE NOTHOMB

*(MSc, Business Management 2023 and co-founder of Cyanoskin, producers of an innovative living algae paint that transforms buildings into carbon dioxide-absorbing structures)*

### What is Cyanoskin?

**A.** I'd wanted to do something in sustainability and was always passionate about biomimicry – replicating nature's solutions. Cyanoskin is a completely new carbon capture approach. It's an algae-based coating that we can spray onto the façade of any building, and through photosynthesis it absorbs CO<sub>2</sub>. Because it's living, it's constantly growing, so it's constantly capturing the carbon, and we use a sensor and dashboard to track how much is captured.

### Who is it aimed at?

**A.** It's mainly construction companies who want to reach their net zero targets for their clients. In the EU, with its tight regulations and fines if you don't reach those targets, it's straightforward, but in the US, without that regulation, it's a much different pitch.

### Why did you choose Imperial?

**A.** If you want to start a business and want an 'in' into the EU and UK markets, Imperial is the best in Europe. I launched my business there, they helped us go full time, supported us with grants, pushed us in front of the right people, gave us legal advice, IP help, free lab space, free offices... everything! But my eureka moment was meeting Emma Money from the Royal College of Art, who had been developing algae paint. She showed me her ideas, I showed her mine and together we realised we had something we could scale.

### What role can Imperial play in the future?

**A.** Imperial's forward thinking is helping to change the world. In five years I would like to see Cyanoskin proving our technology, gaining a significant chunk of the UK and EU markets and starting to take off in the US. We have one of the strongest solutions to carbon capture out there – and Imperial's support is continuing to make our company bigger and better. This year we won Imperial Enterprise Lab's Venture Catalyst Challenge and we still have all the support of lab space, offices and other practical support. Imperial itself has such a commitment to its students and its startups, but more than that, to invention and innovation. There's no place quite like it.



## SOLOMON ASAMOAH

*(MEng, Chemical Engineering 1987, investment consultant and former CEO of the Ghana Infrastructure Investment)*

### Your Imperial degree was in chemical engineering. How did you get into infrastructure investment?

**A.** As I was completing my degree, all the investment banks descended on Imperial trying to recruit engineers – problem-solvers. I joined HSBC but, as a Ghanaian, I wanted to be involved in investment banking in Africa, so I left to work for the International Finance Corporation, first in Washington and then across Africa.

### Does an interest in African investment logically lead on to infrastructure?

**A.** I do think that if you're wanting to make a positive impact in the world, you inevitably try to figure out what is preventing emerging markets from growing – and in Africa, that's infrastructure. With good infrastructure you can keep value on the continent – set up manufacturing industries that will lead to greater economic growth and skills development.

### How crucial would you say is infrastructure investment in Africa?

**A.** The best way for Africa to develop is to process and add its own value, rather than be dependent on the graces of the other parts of the world. That's why there's been such a backlash on aid – should the money be spent helping people live or invested to generate jobs, encourage local innovation and local wealth? A booming Africa benefits the developed world. Migrants come into Europe and the US for a better life – they won't do that if there is opportunity at home, and I think western governments are beginning to understand and embrace that idea.

### What role can Imperial play?

**A.** The university is setting up a hub in Ghana and approached me to help. It's working on an operation to bring Imperial science and engineering students to work in Ghana on infrastructure and sustainable development. We need more innovation, new ways of producing power, and new ways of laying roads and constructing buildings to ensure they are sustainable. Imperial's interaction with Ghana and other African countries is really pushing this forward, and as an Imperial graduate I'm really proud of that.

INTERVIEWS: KAT BROWN



## SINÉAD CONNEELY

*(MSc Applied Mathematics 2009, Executive MBA 2024 and co-founder of Simple Works, a socially conscious structural engineering company)*

### How has your Imperial experience shaped you?

**A.** I think most of all, Imperial broadens the way you think. I was good at maths at school but coming here I realised I knew nothing – it was all in the same broad sphere yet somehow completely different. And now I'm doing my Executive MBA, which is excellent – a technical programme at a university that's really focused on tech and innovation. Because of my Imperial background, I'm already thinking that way.

### How did you start Simple Works?

**A.** It all stemmed from that different way of thinking. My co-founders and I were all working together at a bigger consultancy and we got disillusioned, asking: 'Who are these projects really serving?' We wanted to ensure the projects we worked on are for the many, for the cities and communities we work in. As Simple Works, we've built up a portfolio of mostly affordable social rent housing, that also focuses on environment and sustainability.

### Do you see yourselves as innovators?

**A.** I think we were maybe at the vanguard of our generation, wanting to do things differently, but I think it's the generation behind us who are truly outraged and demanding better. We were just the start, but in that next generation the majority want better cities.

### Where are the challenges?

**A.** The sad truth is that for projects of social value, fees are lower. Councils, charities, community groups have fewer funds so it's a difficult balance to deliver really good engineering work and get paid properly for it. There's only so much public money available and therefore you have to be innovative if you're going to deliver quality with that. And since around 80 per cent of the buildings that will exist in 2050 have already been built, we need to look more at energy efficient refurbishments and extensions. There's a greater need than ever to think holistically and consider things in the round – it's about innovative problem-solving, weighing up social value versus environmental value. As a society we need Imperial to keep encouraging people to do that, and push back the boundaries.

MY IMPERIAL

## PARK AND RIDE

Carys Bill (Second year PhD student in Earth Science and Engineering and Kentfield Legacy Sports Scholar) is the ultimate triple threat.

Interview: Greer McNally / Photography: Hannah Maule-ffinch

**W**hen you spend your days modelling the Moon's impact craters, it's nice to have the option to step outside and relax. That's why I love spending time in Richmond Park, the ultimate perk of being in the capital. It's one of the few real open green spaces in London and, as a triathlete, it's perfect for my training.

I took up triathlon when I was an undergrad. I'd done some swimming when I was much younger and quite a lot of cross country. Then I got my first road bike on my 14th birthday

### You can't beat Richmond Park in the evening, when it's just you, the deer and a heart-stopping sunset

and started going out with my dad on what felt like really long rides. It was only a 22km route, but it seemed huge back then.

It's only in the past two or three years that I've really started to take things seriously, and these days my rides are three or four hours long. Being part of Imperial's sports programme has really worked to improve my performance. They've helped me avoid injuries and just made me stronger, which is amazing. And now I'm proud to represent the Team GB triathlon age-group team, winning my first championship race this summer.

I'm lucky because I actually live closer to Richmond Park than I do to campus, which is great for my training. During the week it's a 20-minute ride into Imperial, and at weekends my triathlon club organises rides, and we'll head out of the city to places like Surrey. Although this year I ventured even further – while camping out in the Arizona desert to do fieldwork and follow in the footsteps of astronauts training at Meteor Crater, I managed to get in a few runs along the rim of the Grand Canyon. But the trip wasn't without mishap. En route my hold luggage went missing; thankfully it turned up in time for our Grand Canyon trip.

But back at home you just can't beat Richmond Park in the evening, when it's just you, the deer and a heart-stopping sunset as you look across the fields. You have to be careful of the deer, obviously, but it's really how I relax. In the summer there are lots of other people out on their bikes in the park. You see the same faces. I'll often go around on my own, but bump into people I know. There's a real sense of community.

Because at the end of the day, it's all about finding a balance. Even in the three triathlon disciplines, I have good days and bad days – but when I'm training, it's just me and my environment. ♦



Carys Bill  
photographed at  
Richmond Park.

# IMPERIAL Get connected

Our events are free and open to all, so whether you are looking to get hands-on with experiments or find out the most recent advances in science, our programme has something for you.

### Lunchtime concert

Thursday 9 January 2025  
South Kensington Campus

Enjoy music from the principals of Covent Garden Sinfonia as they perform Bartók's Piano Quintet Sz 23 at this free lunchtime concert. Covent Garden Sinfonia are one of London's most dynamic and versatile chamber orchestras.

[www.imperial.ac.uk/events/181572/lunchtime-concert-principals-of-covent-garden-sinfonia](http://www.imperial.ac.uk/events/181572/lunchtime-concert-principals-of-covent-garden-sinfonia)

### Imperial Lates: Weird Science

Thursday 6 February 2025  
South Kensington Campus

Lift the lid on the 'weird' side of science and learn all about the unexpected and surprising new research happening at Imperial. Enjoy food, a bar and live music while getting hands-on with the latest and weirdest scientific developments at this exciting evening of discovery.

[www.imperial.ac.uk/be-inspired/latelates](http://www.imperial.ac.uk/be-inspired/latelates)

### Art exhibition

8–30 January 2025  
South Kensington Campus

The latest free exhibition at the Blyth Gallery is called 'Lost and Found'. It features work from artists Andrew Ekins, Jeremy Bubb, Jane Millar, Dave Farnham and others. The Blyth Gallery on Level 5 of Sheffield Building is an artist-run space for creative exploration of ambitious visual projects.

[www.imperial.ac.uk/events/179272/lost-and-found-2](http://www.imperial.ac.uk/events/179272/lost-and-found-2)



The Great Exhibition Road Festival

### Great Exhibition Road Festival

7 and 8 June 2025  
South Kensington

Join us in South Kensington this summer as we celebrate science and the arts with a weekend of incredible free events for all ages! Returning for another year, this summer's Festival will have a packed programme of fascinating talks, hands-on creative workshops, interactive shows and live performances from Imperial and South Kensington's iconic museums.

[www.greatexhibitionroadfestival.co.uk](http://www.greatexhibitionroadfestival.co.uk)

### Sign up for events updates

Join our mailing list and receive the latest on free public events at Imperial College London, delivered straight to your inbox. From engaging science lectures by leading experts to interactive Lates events, concerts, and exhibitions – explore something new each month.

[www.imperial.ac.uk/whats-on/events-signup](http://www.imperial.ac.uk/whats-on/events-signup)

### Imperial inaugurals

Celebrate our newest professors as they share insights from pioneering research across Science, Technology, Engineering, Medicine, and Business. Engage with groundbreaking ideas, ask questions, and connect with experts. Imperial Inaugurals are open to all and free to attend.

Wednesday 8 January

Professor Hamed Haddadi, Department of Computing

Wednesday 28 January

Professor Mitesh Patel, Department of Physics

Wednesday 5 February

Professor Johannes Lischner, Department of Materials

Wednesday 12 February

Professor Stephan Seiler, Imperial College Business School

Wednesday 19 February

Professor Matthew Santer, Department of Aeronautics

Wednesday 26 February

Professor Will Branford, Department of Physics

Wednesday 5 March

Professor Otavio Berwanger, School of Public Health

Wednesday 12 March

Professor Doryen Bubeck, Department of Life Sciences

Wednesday 19 March

Professor Mohamed Shamji, National Heart and Lung Institute



Please visit our website for the most up-to-date event information and to register your interest online:  
[www.imperial.ac.uk/whats-on](http://www.imperial.ac.uk/whats-on)