

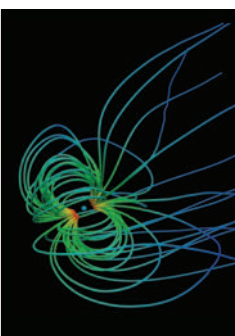


Cosmic Catch

The hunt for the universe's
missing matter ... CENTRE PAGES



**BILLION
DOLLAR CLUB**
Imperial
Incubator marks
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spin-outs
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**LONELY
PLANET**
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PROMISE**
Landmark
trial of gene
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cystic fibrosis
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EDITOR'S CORNER

Faith in science

At first glance, there seems little to link our two main stories this month – focused on the quest to find dark matter (page 8) and delivering gene therapy for cystic fibrosis (pages 6 & 10). But for me it quickly became clear that both are prime examples of researchers doggedly pursuing a very **singular goal** for more than 25 years – a goal which by no means was ever guaranteed to be achieved. For a time it looked like gene therapy was just too complex to ever be a practical treatment for patients, while dark matter still eludes. But as physicist Tim Sumner explains, there has to be a level of naïve **optimism** to begin with otherwise no one would ever try anything difficult. Then in the midst of the projects, through the **myriad challenges**, there has to be a solid belief in what you are doing – perhaps even a sort of faith that goes beyond statistical confidence. That's something that's rarely appreciated in our instantaneous, hyper-connected modern world. As ever, the best things are worth waiting for.

ANDREW CZYZEWSKI, EDITOR

Reporter is published every three weeks during term time in print and online. Contact Andrew Czyzewski: reporter@imperial.ac.uk

Imperial Incubator celebrates billion dollar spinout success

The Imperial Incubator celebrated its spinout companies' extraordinary growth at a special 'graduation' event yesterday.

A hub for innovation and entrepreneurship, the South Kensington based Incubator provides office and laboratory space for science and tech based startup companies. In under a decade, 60 companies have grown within its walls, attracting £750 million (\$1.2 billion) of investment.

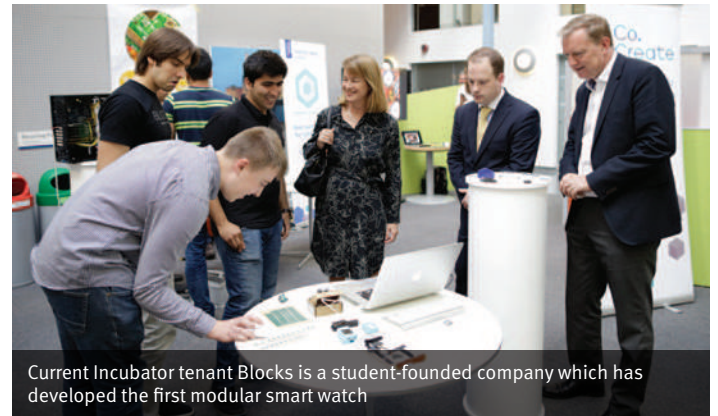
The graduation ceremony, held on 21 July, celebrated the achievements of four companies that have outgrown the Incubator this year. These include image recognition specialist Cortexica, which developed the FindSimilar software used by retailers such as Macy's and Net-a-Porter, allergy testing service Microtest DX, clean cold technology company Dearman, and lung disease drug discovery firm RespiVert. All are moving to larger facilities for their next stages of development, with Microtest DX taking advantage of new incubation facilities at the College's White City Campus.

Imperial's President, Professor Alice Gast, presented awards to representatives of the four firms to mark their achievements. The evening also gave current and new companies based in the Imperial Incubator the chance to showcase their technology and products. These included Blocks, a student-founded company which has developed the world's first modular smart watch, and Econic, which is developing catalysts that allow for the integration of carbon dioxide in the production of plastics.

Professor David Gann, Vice President (Development & Innovation) at Imperial, said: "It is extraordinary to see how much value has been created in the Imperial Incubator. The products conceived, jobs created and investment attracted are great



MotionMetrics is working on the world's first wearable technology dedicated to skiers.



Current Incubator tenant Blocks is a student-founded company which has developed the first modular smart watch

news for Imperial, London and the world.

Graham Hewson, Incubator Manager at Imperial Innovations, added: "The graduating companies tonight have achieved tremendous success so far in getting their products to market. We are honoured to have helped their development and wish them the best of luck in their future endeavours."

—DEBORAH EVANSON AND ANDREW SCHEUBER, COMMUNICATIONS AND PUBLIC AFFAIRS

"The products conceived, jobs created and investment attracted are great news for Imperial, London and the world."

Imperial College
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Be Secure

Green light for new biomedical engineering centre

Hammersmith and Fulham Council has granted planning permission for construction of the Michael Uren Biomedical Engineering Research Hub.

The new 13-storey centre on Imperial's White City Campus will provide flexible accommodation for translational research initiatives at the interface of biomedical sciences and engineering. It will house research laboratories, an outpatient clinic, a 150-seat auditorium and a series of social spaces to encourage informal exchange of ideas.

The new centre has been supported by an unprecedented £40 million gift from Imperial alumnus Michael Uren OBE and his Foundation.

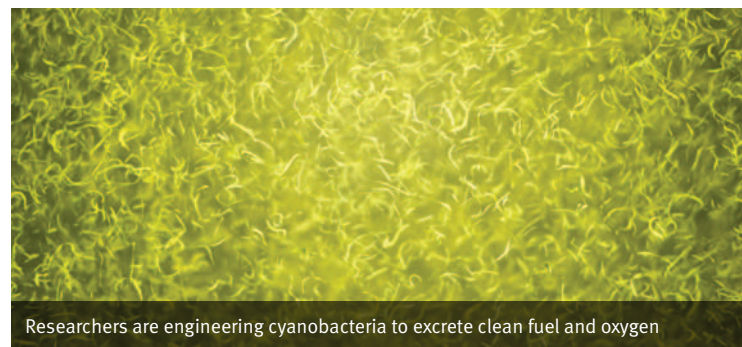
Graham Stark, who recently joined Imperial as Development Director for the White City Campus, said: "The Michael Uren Biomedical Engineering Research Hub will harness the expertise of our engineers, scientists and researchers under one roof – to drive forward medical technology and bring direct benefits to patients. We look forward to continuing to work with the Council, local community and colleagues as we realise this important step for our White City Campus."

The new centre is a key component of Imperial's White City Campus, the first development of which include publicly accessible green space, student accommodation, local retail facilities, and a pedestrian cycle route, driving the creation of thousands of jobs.

Imperial's plans for the Michael Uren Biomedical Engineering Research Hub went on display at a public exhibition onsite in November 2014, with members of the project team on hand to explain the proposals and to answer questions from visitors.



Donor Michael Uren OBE on the site of the Biomedical Engineering Research Hub



Researchers are engineering cyanobacteria to excrete clean fuel and oxygen

€6million for EU green fuels project

A project to develop clean fuels using microscopic organisms called cyanobacteria has been given the green light.

Imperial researchers are part of the €6 million PhotoFuel consortium, which is led by the car manufacturer Volkswagen, and includes five other academic partners and a further six industrial collaborators.

Cyanobacteria get their energy from sunlight through photosynthesis and excrete oxygen as a by-product. Researchers are seeking to re-engineer cyanobacteria to produce low-carbon liquid fuel as well as oxygen. The idea is to create a prototype bioreactor that will feed sunlight, water and carbon dioxide to the cyanobacteria, which will convert it into clean alkane and alcohol fuels.

As part of the consortium, the Imperial researchers will focus on two major projects, which have received €1.17 million. One group, led by Dr Patrik Jones (Life Sciences), will focus on developing cyanobacteria strains that are capable of producing the fuels. The other, led by Professor Klaus Hellgardt (Chemical Engineering), will focus on optimising the living conditions for the cyanobacteria inside the prototype bioreactor.

Dr Jones said: "Billions of years ago these little oxygen-producing organisms may have played an important role in helping our planet to be more liveable. Now we are enlisting their help to help fight against the world becoming a more hostile place through climate change.

"If we achieve what we're setting out to, one day you might be able to fill up your car using fuel excreted by these microscopic organisms as a by-product of their daily diet."

The European Union is funding the four-year project through its Horizons 2020 programme.

—COLIN SMITH, COMMUNICATIONS AND PUBLIC AFFAIRS

in brief



Dr Timothy Harris, Prime Minister, St Kitts and Nevis (left) visiting the HELIX pop-up studio.

Caribbean leader visits

Imperial welcomed St Kitts and Nevis Prime Minister Dr Timothy Harris to St Mary's Campus on Thursday 9 July, as part of his UK visit. Prime Minister Harris has a strong interest in healthcare and came to Imperial to establish ties and learn more about the College's work to tackle diseases such as cancer, asthma and diabetes. He met Imperial's President Professor Alice Gast before touring the Health Innovation Exchange (HELIX) pop-up studio, located on the St Mary's Campus, and the Surgical Innovation Centre, a joint initiative with Imperial College Healthcare NHS Trust.

Executive education expands

The Business School will bring its Executive Education to audiences in Asia and South America with a new partnership. It already offers open and bespoke programmes in areas such as risk management, finance and innovation which attract business executives from a wide range of industries. The new partnership with the *Financial Times* and the IE Business School in Spain will enable the Executive Education programmes to run through local business schools and education institutions based in countries including China, South America and Singapore.

Tweet of the month

“Thanks to Imperial Exploration Board for starting my career in exploration. Two expeditions they supported!”



ANDREAS MORGENSEN (@ASTRO_ANDREAS), ESA ASTRONAUT AND IMPERIAL ALUMNUS, RESPONDS TO NEWS OF THIS YEAR'S EXPLORATION BOARD TRIPS.

Imperial explores the next 20 years of digital tech and robotics

Last month academics, industry experts and business leaders looked to 2035 to explore future challenges, emerging tech, and the next big ideas.

At Imperial's 2035: Tech Foresight event on 3 July, Imperial scientists were joined by leading figures from industry – including Sam Dickinson, Lead Inventor of Google and Mike Hearn, Lead Developer of Bitcoin.

The one day conference, held by Foresight Practice for Imperial Business Partners, was designed to prepare corporate leaders for the way that today's lab discoveries could lead to future tech innovation.

Keynote speaker Professor Guang-Zhong Yang, Director of the Hamlyn Centre for Robotic Surgery, noted that an increasingly cooperative man-machine relationship that will extend the range of human capability far beyond its biological limits.

Other Imperial speakers who laid out their visions for the next 20 years included Dr Will Knottenbelt (Computing). He discussed how governments, commerce and individuals could reap the benefits of digital currencies such as Bitcoin, as well as the block chain public transaction ledger.

Guests also experienced technology demonstrations, and stretched their thinking in breakout groups and panel discussions.

Launching the conference President Alice Gast said: "Advances in digitisation, automation, artificial intelligence and robotics have improved our world immeasurably. They have reduced time to market, shortened supply chains, led to higher precision manufacturing methods, and changed how businesses respond to their customers."

—DEBORAH EVANSON, COMMUNICATIONS AND PUBLIC AFFAIRS



Clinician training boost



Imperial has been awarded funding to create new research and education training positions for clinicians in general practice, anaesthetics and intensive care medicine.

The panel at the National Institute for Health Research (NIHR) awarded four Academic Clinical Fellow (ACFs) posts and one Clinical Lecturer (CL) post to Imperial College London and Imperial College Healthcare NHS Trust. The new posts are among the highest amount awarded in the competition round and brings Imperial's total number of positions to 30 this year.

The clinical fellowships are aimed at medical trainees who want to undertake research and clinical training over three

years. Under the fellowships, trainees will also be offered networking, mentoring and guidance on applying for further funding. The clinical lectureship post is a four year speciality training position that incorporates academic training.

Dr Jeremy Levy, Director of the Clinical Academic Training Office (CATO), said: "Education and training is a vital part of our activities and Imperial's track record on this has been excellent so far. I want to expand on our activities and these new posts will allow us to reach out to more clinicians at the College and Trust to help them develop and progress in their academic careers."

—MAXINE MYERS, COMMUNICATIONS AND PUBLIC AFFAIRS



Summer research placements offer insights abroad

This month Imperial welcomed 40 incoming students – temporarily joining the College as part of the International Summer Research Placement scheme.

The scheme also offers Imperial students the opportunity to undertake research in an international setting and this year 38 Imperial students are going to universities in five different countries, including Tsinghua University in China and the Massachusetts Institute of Technology (MIT) in the USA.

The incoming students are undertaking research placements in 13 departments in the Faculties of Engineering and Natural Sciences. Emily Kazarinoff, a student from MIT, who is doing a research placement in Bioengineering, said: "I'm working in the human robotics lab, designing a game for kids with cerebral palsy which will help with physio and cognitive rehab".

On hand to greet visitors from the scheme at a welcome event on 8 July were Imperial students who had taken part in previous years. Nick Rome (Mathematics) did a research placement last summer at the University of British Columbia (UBC). Professor Neil Alford, Vice Dean for Research in the Faculty of Engineering, said: "This scheme is a great opportunity for young scientists. Doing research in an international setting – possibly somewhere totally unfamiliar and different from their home university – is a very valuable experience. It offers the chance to make new connections and learn new techniques."

The scheme is coordinated by the International Relations Office, and member of staff Laura Bulmer won a President's Medal for her work supporting the scheme.

—ELIZABETH NIXON, COMMUNICATIONS AND PUBLIC AFFAIRS

Find out more about the scheme here: bit.ly/summer-res

media mentions



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Britain needs brains

MAIL ON SUNDAY ▶ 19.07.15

Writing in the *Mail on Sunday*, Sir James Dyson questions Business Secretary Sajid Javid's call for foreign students to be expelled after their course. "I wholeheartedly disagree," he says. "The UK needs to harness talent for its own good, regardless of nationality. Dyson sponsors university scholarships through its charitable foundation. One such scholar is an American PhD student at Imperial. He is researching new ways to tackle pancreatic cancer: it is my fervent hope that this clever young man will stay in the UK after graduation – potentially earning our economy millions and saving lives. But if the Government has its way, we'll lose both the technology, and the brains behind it."

Is there such thing as the beginning and end of time?

NEW STATESMAN ▶ 23.07.15

In homage to the 60th anniversary of the world's first atomic clock, *The New Statesman* asks what time actually is and whether it even exists. "Seventy per cent of our universe is made of an unknown type of force that we call 'dark energy', whose main impact is to make the expansion of the universe accelerate with time," says astrophysicist Roberto Trotta (Physics). He added: "The Big Crunch will end the universe in a state of darkness where all the matter will have been sucked into black holes... but it's about 200 billion years in the future so we've got nothing to worry about."

Vested interests and low-cost homes

FINANCIAL TIMES ▶ 22.07.15

Writing in the *Financial Times*, Professor Richard Green (Business School) rues the shortage of affordable housing the UK and the attitude of developers: "Social housing does not increase the cost of building, in the sense of putting one brick on top of another. It reduces the revenue gained from developing a site. But developing

a site is still worthwhile if that value is more than the site is currently worth, either unoccupied or with low-value buildings. There are many places in the UK where house prices can be high enough to make development worthwhile, even with a significant proportion of social housing. But if speculative land prices are based on the assumption that planning permission can be gained without having to build social housing (or energy-efficient buildings), those prices will be higher. Landowners and developers have a vested interest in arguing that adding social housing (or insulation) will make their schemes 'unviable', and a government that treats land prices as given is playing into their hands."

Students told to cut 'corny' quotes

THE SUNDAY TIMES ▶ 26.07.15

Universities have called time on sixth formers who litter their applications with 'corny' quotes from famous people to impress academics, *The Sunday Times* reports. Jane Marshall (Outreach), Widening Participation Officer, at Imperial, advises applicants to: "explain the relevance of the quotation and not leave it sparkling at the top of the page like a Christmas decoration that never gets mentioned again."



awards and honours

NATURAL SCIENCES

Magnificent mentor

Dr Mark Richards (Physics) has been presented with a special recognition award from the Amos Bursary, which supports young men of British African and Caribbean heritage from schools and sixth form colleges in London. Dr Richards was noted for his instrumental role in solidifying the relationship between Imperial and the Amos Bursary and also commended for the 6 week programme of physics master classes he set up



to help A-level students reach a level from which they could apply to top universities.

COLLEGE

Trio of comms and marketing awards

Staff from Communications and Public Affairs, Student Recruitment & Outreach, and ICT collected three HEIST awards last month to recognise best practice in communications and marketing in higher education. The redesigned undergraduate prospectus earned Imperial a gold award, and there was also a gold for the College's communications campaign about animal research. Imperial's new website gained a silver award.

MEDICINE

Medic masterminds shine

Two Imperial students have been recognised at a prestigious competition involving medical schools across the capital. Rahul Ravindran won top prize at The University of London Gold Medal Viva. Classmate Ashik Amlani was runner up. Participants are nominated by their medical schools then tested on their knowledge of specialisms including pathology, medicine



Rahul Ravindran and Ashik Amlani

and surgery. Previous recipients include a young Alexander Fleming, who went on to discover penicillin winning him the 1945 Nobel Prize.

ENGINEERING

Engineer wins top national award

An Imperial engineer has received one of Portugal's highest honours. Dr Zita Martins (Earth Science and Engineering) was appointed an Officer of the Order of Saint James of the Sword for exceptional and outstanding merits in science. It is the equivalent of receiving an OBE in the UK. Dr Martins received the associated medal from the President of Portugal, Dr Aníbal António Cavaco Silva.

‘Landmark’ gene therapy trial results hailed

A therapy that replaces the faulty gene responsible for cystic fibrosis in patients’ lungs has produced encouraging results in a major UK trial.

Cystic fibrosis (CF) is the commonest lethal inherited disease in the UK, affecting around 10,000 people nationally. Patients’ lungs become filled with thick sticky mucus and they are vulnerable to recurrent chest infections, which eventually destroy the lungs.

The cause of CF, mutations in a gene located on chromosome 7, was identified in 1989, opening the door to introducing a normal copy of this gene using gene therapy.

In the latest trial, patients were treated by inhaling molecules of DNA wrapped in fat globules (liposomes) that deliver the gene into the cells in the lung lining. In all, 136 patients received monthly doses of either the therapy or the placebo for one year.

The clinical trial reached its primary endpoint with patients who received therapy having a significant, if modest benefit in lung function compared with those receiving a placebo.

The study was carried out by the UK Cystic Fibrosis Gene Therapy Consortium, a group of scientists and clinical teams from Imperial, the Universities of Oxford and Edinburgh, Royal Brompton & Harefield NHS Foundation Trust and NHS Lothian who came together in 2001 to develop a gene therapy, supported by the Cystic Fibrosis Trust. The current trial was launched in 2012 and funded by the Medical Research Council (MRC) and the National Institute for Health Research (NIHR).

Professor Eric Alton (NHLI) the coordinator of the Consortium, who is also a consultant physician at Royal Brompton Hospital, said: “Publication of this trial is a landmark for CF patients. Our aim is to achieve a step change in the treatment of CF that focuses on the basic defect rather than just addressing the symptoms. It has taken more than 20 years to get where we are now, and there is still



Patients receive the therapy by inhaling fat globules containing DNA from a nebuliser

Transformative

Mary Bondonno, 16, from Morden, Surrey, took part in the trial and was given the gene therapy. Mary’s lung function went from 66.72 per cent to 80.29 per cent at the end.

“Before the trial I found it very difficult to clear my lungs of mucus,” she said. “I spent a lot of time in hospital because of repeated infections. Activities like PE at school would leave me out of breath very quickly.

“This all changed for me once I went on the trial and within a month of getting the first dose of the gene therapy I noticed improvements in my condition. I was able to clear my lungs better, concentrate more at school because I wasn’t as tired and I was able to do more with my family like go for walks. It felt good to see my condition improving and I felt better overall.”



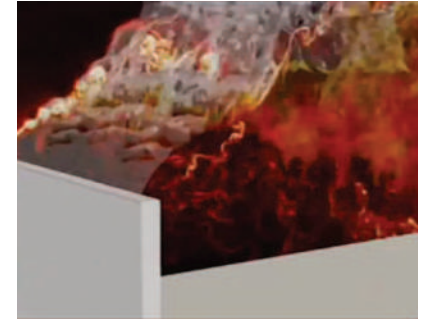
“We hope gene therapy will push Cystic Fibrosis patients towards a normal life expectancy and improve their quality of life significantly.”

some way to go. Eventually we hope gene therapy will push CF patients towards a normal life expectancy and improve their quality of life significantly.”

The Consortium is now looking to undertake follow-up studies assessing higher, more frequent doses as well as combinations with other treatments.

—SAM WONG AND MAXINE MYERS, COMMUNICATIONS AND PUBLIC AFFAIRS

See page 10 for an interview with Professor Alton



Modelling tool to harness the power of “unsteady air”

The design process for vehicle manufacturers could be improved with the help of new computer software that predicts the effects of airflow.

In nature, unsteady pockets of air called vortices occur in many places, for instance in the form of ocean whirlpools and hurricanes. On a smaller scale vortices in the air pose a problem for engineers who need to understand their effect on various vehicles. For example, aircraft wings can be damaged when a vortex of air causes it to vibrate in a phenomenon called “flutter”.

Dr Peter Vincent (Aeronautics) and his colleagues have developed a mathematical modelling tool that can better predict the effect of vortices on vehicles. The advantage of this new technology is that engineers could detect the challenges posed by vortices much earlier in the design process.

“Manufacturers don’t fully understand how to effectively simulate and model these vortex flows and this can be a problem when you’re designing computationally,” Dr Vincent says.

He predicts the new technology could have a wide range of applications such as harnessing vortices to make Formula One cars more road-hugging.

—COLIN SMITH AND MARTIN SAYERS, COMMUNICATIONS AND PUBLIC AFFAIRS

Watch a video about the developmental of the model: bit.ly/vortex-model





Animal spirits

Economists have long recognised that the unpredictability of human behaviour can make financial markets unstable. John Maynard Keynes wrote of “animal spirits” and Alan Greenspan and Robert Shiller alluded to “irrational exuberance” as a possible cause of overvaluations in asset markets. However, scientists have only recently begun to explore the physiological basis for this phenomenon.

Traders’ hormones ‘may destabilise financial markets’

The hormones testosterone and cortisol may destabilise financial markets by making traders take more risks, according to a study.

Researchers simulated the trading floor with 142 male and female volunteers buying and selling assets among themselves as part of a trading game. They measured the volunteers’ natural hormone levels in one experiment and artificially raised them in another.

Those who had higher levels of cortisol were more likely to take risks, and high levels in the group were associated with instability in prices. When given doses of artificial hormone, cortisol appeared to directly affect volunteers’ preference for riskier assets, while testosterone seemed to increase optimism about how prices would change in the future.

The researchers think the stressful and competitive environment of financial markets may promote high levels of cortisol and testosterone in traders. Cortisol is elevated in response to physical or psychological stress, increasing blood sugar and preparing the body

for a fight-or-flight response. Previous studies have shown that men with higher testosterone levels are more likely to be confident and successful in competitive situations.

The authors of the new study suggest the findings should be considered by policymakers looking to develop more stable financial institutions.

“The results suggest that cortisol and testosterone promote risky investment behaviour in the short run,” said co-lead author Dr Ed Roberts (Medicine).

“Our aim is to understand more about what these hormones do. Then we can look at the environment in which traders work, and think about whether it’s too stressful or too competitive. These factors could be affecting traders’ hormones and having an impact on their

decision-making.”

The authors note that it would be interesting to measure traders’ hormone levels in the real world, and also to see what the longer term effects might be.

—SAM WONG, COMMUNICATIONS AND PUBLIC AFFAIRS

“The results suggest that cortisol and testosterone promote risky investment behaviour.”

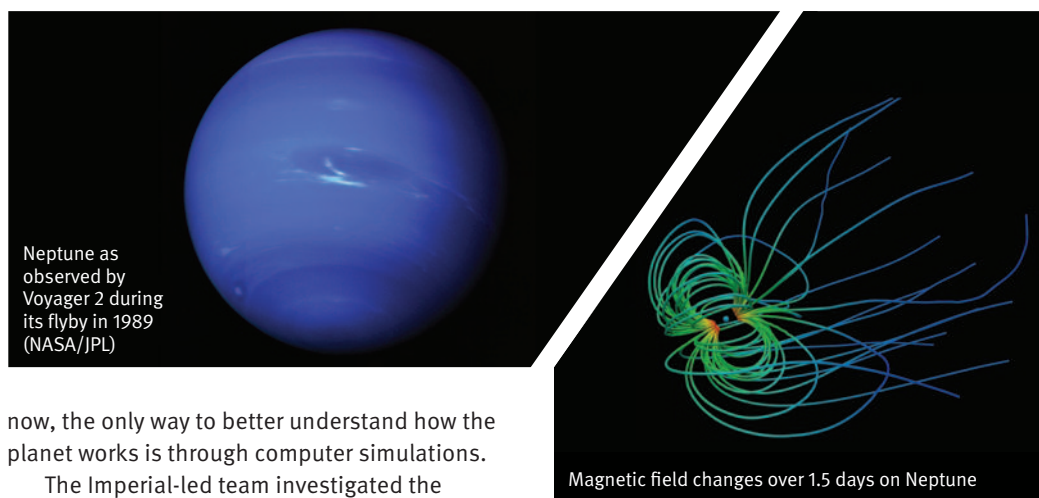
Lonely planet

Scientists have made the first detailed simulation of the magnetic field surrounding Neptune, the outermost planet in our solar system.

They combined 26-year old data from Nasa’s Voyager 2 probe, with new supercomputer calculations and found a magnetic field that is perpetually changing and rotating on a different axis to the planet.

By studying this model further they hope to improve their understanding of how the Earth’s magnetic field controls our space weather. This could help our ability to forecast geomagnetic storms, which can affect communications satellites, computers and other everyday electronics on Earth.

When Voyager 2 passed Neptune in 1989 it revealed that the planet’s rotation axis is tilted relative to the Sun, its magnetic axis is not at all aligned with its rotation and its magnetic field has a lopsided shape (pictured). There are no new missions planned to study Neptune so for



Neptune as observed by Voyager 2 during its flyby in 1989 (NASA/JPL)

Magnetic field changes over 1.5 days on Neptune

now, the only way to better understand how the planet works is through computer simulations.

The Imperial-led team investigated the interaction between Neptune’s magnetic field and the solar wind – a stream of charged particles, or plasma – emitted by the Sun. They created a simulation of the resulting ‘magnetosphere’ using the Science and Technology Facilities Council’s DiRAC supercomputer.

“Modelling a whole planet is no easy task. But supercomputers now make it possible and the new simulations explain a lot of what Voyager saw all those years ago,” said

team member Dr Adam Masters who worked alongside Dr Jonathan Eastwood and Professor Jerry Chittenden (all Physics).

Understanding Neptune better will also help astronomers understand exoplanets outside the solar system. A large number of those found to date are around the size of Neptune, so studying this planet should give an insight into conditions on those other distant worlds.

—SIMON LEVEY, COMMUNICATIONS AND PUBLIC AFFAIRS

Elusive quarry

Imperial scientists have been at the forefront of the hunt for dark matter for decades – work which continues apace today with a series of bold experiments.

It's astonishing to think how much humanity has learned about the world around us in just a few centuries of rigorous scientific enquiry, observation and experimentation – from the intricate mechanism of DNA replication to the surface composition of Pluto.

Yet despite these successes, we've been unable to land literally the biggest catch of them all – the stuff that makes up 80% of all the mass in the universe we inhabit. Something physicists call 'dark matter'.

In fairness, it's rather elusive quarry, emitting no light or radiation and apparently able to pass through normal matter virtually unhindered. Effectively it's invisible.

The only clue that dark matter even exists comes from the cosmic footprints it leaves. All galaxies tend to spin around their axis, with stars at the outer edges moving the quickest, like a weight swung on a string. Yet when astronomers first clocked the speed of these periphery stars they seemed to be going too fast for their host galaxies to hold on to them – they should have been simply shooting off into space. They concluded that there had to be extra invisible matter which we couldn't see with telescopes providing added gravitation pull to hang on to them.

Astronomers have now seen many footprints of dark matter in the cosmos, but never the stuff itself – not a scrap. But in the spirit of scientific endeavour it hasn't stopped people trying – and Imperial physicists have been at the forefront of this audacious task for nearly 30 years.

Stab in the dark

In the mid-1980s, scientists from the UK's Rutherford Appleton Laboratory led by Professor Peter Smith started thinking conceptually about how they might directly detect dark matter. They began to consult people with expertise in high sensitivity instrumentation – including Imperial professors Tim Sumner and John Quenby (Physics) who had recently done work detecting cosmic X-rays with the ROSAT space telescope.

Because dark matter appeared to interact with gravity, as normal matter does, it seemed logical to conclude it was made of particles, as normal is. And because of the sheer abundance of dark matter, it should pass

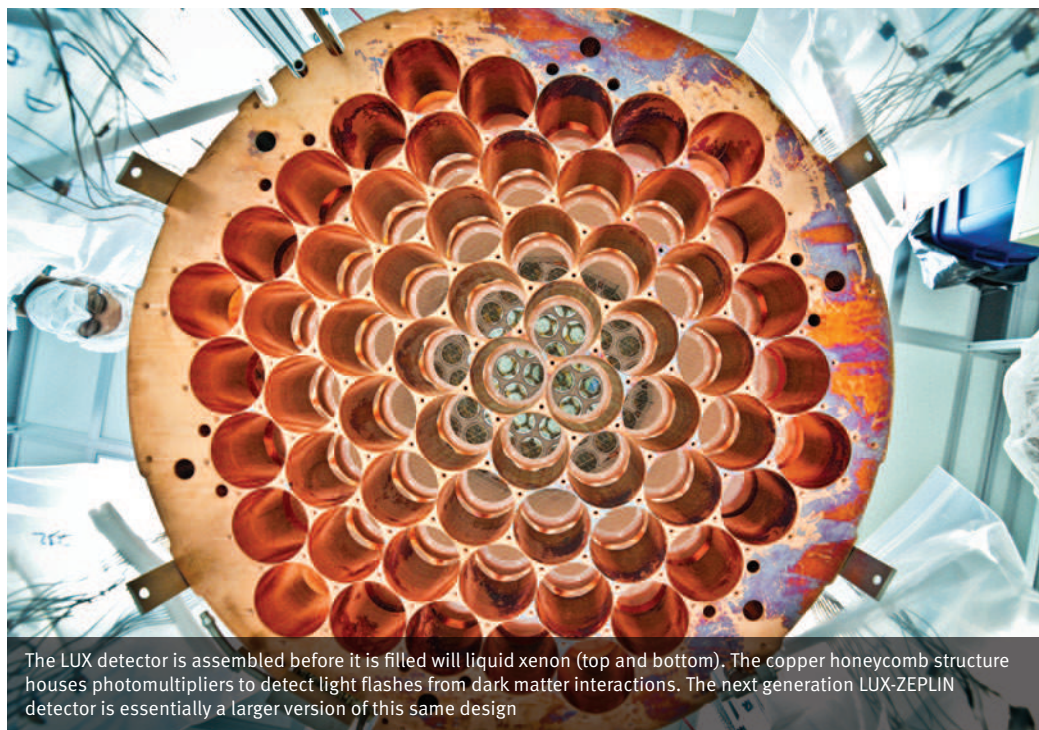
through the Earth quite frequently. So with a suitably sensitive detector it might be possible to catch the weak, fleeting interactions of dark matter with normal matter, the team thought.

Yet any signal would be almost infinitesimally faint and require an incredibly quiet place to hear it, free from the interfering 'noise' of cosmic rays and background radiation, and preferably underground.

"We were incredibly lucky in making contact with a working potash mine in Whitby, North Yorkshire – which was the deepest facility in Europe at the time," recalls Tim. "They bent over backwards to accommodate us, excavating us our own cavern for the detector. We had more or less free reign to do our science – although we couldn't just operate the lift shaft as we

The South Dakota mine, which houses the LUX experiment, will also host the next generation LUX-ZEPLIN experiment





The LUX detector is assembled before it is filled with liquid xenon (top and bottom). The copper honeycomb structure houses photomultiplier tubes to detect light flashes from dark matter interactions. The next generation LUX-ZEPLIN detector is essentially a larger version of this same design

pleased, we had to travel with the miners on their long shifts. It was very hard, hot and dusty work down there. But it was a fruitful time for us.”

Working at the mine, the team developed the underlying technology that would help look for dark matter particles, settling upon a detector made of liquid xenon. As a condensed noble gas, xenon is ordinarily very stable and unreactive, but has the very useful property of sending out a flash of light when particles, including hopefully those of dark matter, nudge its atoms. These flashes are then picked up by photomultiplier tubes at the ends of the detector.

The team refined the technology in a series of experiments called ZEPLIN, the last iteration of which operated until around 2011. Through its detection runs, it demonstrated extremely high levels of sensitivity and won the respect of the physics community with a huge level of citation. It also ruled out the existence of some species of dark matter. Yet it didn't manage to find any actual dark matter particles.

Meanwhile, in the US, a group was building a similar detector called LUX, housed in a disused gold mine in South Dakota which started running in 2013. Like ZEPLIN before it, from which it took design cues, LUX set new standards in sensitivity; but again it has turned up blank for dark matter particles.

“These are incredibly difficult experiments; it's a step-wise process,” Tim explains. “It's easy to look back and say we were naïve to expect to find dark matter in our first attempts, but that is the position you are in when you do something for the very first time – and you have to have a level of optimism otherwise you'd never go into anything.”

Combined forces

The UK and US teams are now formally collaborating to build the next generation dark matter detector called LUX-ZEPLIN, which will be built in the South Dakota mine and will be 100 times more sensitive than the previous LUX experiment.

Imperial leads the UK's involvement in LUX-ZEPLIN following a recent £4.2 million grant from the Science and Technology Facilities



“ We have to believe that this is the right route to discover dark matter.”

Dr Henrique Araujo

Council (STFC), with Dr Henrique Araujo (Physics) serving as Principal Investigator.

With US Government approval and funding in place, the hope is that LUX-ZEPLIN will be running by 2019 – and speaking with researchers there's a palpable sense of anticipation in the field that this will be the experiment to pin down dark matter.

“There's every reason to be confident; we wouldn't be doing it if we weren't,” says Henrique. “Believe me, there are easier ways to earn a living. Building and operating an experiment deep underground is really, really difficult. We have to believe that this is the right route to discovering dark matter. Remember it took nearly 50 years to find the Higgs boson and we've only been looking for dark matter for 30 years. We are not desperate – yet!”

Joined-up thinking

Rather than patiently waiting for cosmic dark matter to turn up, some scientists are taking an altogether more forceful approach to the problem by trying to actually create dark matter by smashing protons together at CERN's Large Hadron Collider (LHC) in Geneva. The LHC seeks to replicate the extreme high energy conditions that were present at the big bang. And since dark matter was created in the big bang alongside regular matter, it's reasonable to assume that it might turn up in the aftermath of collisions at CERN.

With the LHC now at full throttle for its second, highest energy run, there is a greater chance that dark matter might turn up.

“It's a very exciting time and everyone is of the mindset that ‘there must be something amazing in there’. After all these are completely unprecedented energies,” says Dr Sarah Malik (Physics) who works at CERN.

In addition to LUX-ZEPLIN and CERN there are a slew of experiments running or planned that are looking for dark matter in very different ways. The point is that these approaches are ultimately complementary, and if a promising signal is found by one approach it can narrow-down and inform the search parameters in another, making this epic game of hide and seek that bit easier.

“It used to be the case that these very different physics communities did not talk to each other that much,” says Henrique. “But now there's a big effort to make sure we're pulling together. There's healthy competition to be the ‘first’, but we will most likely need confirmation to be totally sure.”

We wait with baited breath.

Drs Henrique Araujo, Sarah Malik and Roberto Trotta will discuss dark matter and the quest for new physics in the inaugural lecture of the new Blackett Colloquium series on Saturday 24 October. For more information, contact Stephen Nolan, Alumni Events Officer: s.nolan@imperial.ac.uk



The long game

Eric Alton is Professor of Gene Therapy and Respiratory Medicine at the National Heart and Lung Institute and Honorary Consultant Physician at the Royal Brompton Hospital. As Coordinator of the UK Cystic Fibrosis Gene Therapy Consortium he led a recent successful trial of gene therapy for CF (page 6).

At what point did you really see the potential of gene modification in healthcare?

Around five years into my training I was working on placement at the Royal Brompton and had the chance to learn more about cystic fibrosis. As is often the case, I had a very influential mentor in Professor Duncan Geddes who made CF really interesting. I worked for him in a research capacity and put together a new diagnostic test for CF and that's essentially how I got into the arena. Then a few years later in 1989, the CF gene was cloned and I think only then did it really become obvious that there was a capacity for gene therapy.

In the Imperial community alone we have gene therapy trials now running for heart failure, blindness and Parkinson's disease among other areas. Is the field coming of age?

Yes, although it is still early and we shouldn't overhype it. I've been round and talked to all of Imperial's gene therapists with a view to pulling us together more and sharing resources. It's also important to acknowledge the engagement in the pharmaceutical community. Five years ago no one would touch gene therapy, now firms are investing quite heavily.

It's taken around 25 years to get to where you are now. What has been the mind-set in the group?

The mind-set has always been that we are going to push through with this. There was never a moment's doubt that we would give it our best shot. There are always funding issues and people who say it will work, others who say it will not. But you steer a middle ground, you deliver it and find out what is happening in the patient. The point

we're at the moment is that we have modest and variable improvement in CF. It's not the answer yet. But the mind-set is exactly the same: we push onwards. The question now is: 'what do we need to do to make this into a clinical product'? We think we can increase the dose, reduce the dosing frequency or add small molecules and we are discussing these things with pharmaceutical industry partners now.

Your trial employed liposomes while other approaches use a viral vector to deliver the modified gene to patients. Can you briefly clarify the difference between the methods?

The liposome encapsulates a circular piece of DNA called a plasmid which contains the modified CF gene. That passes through the cell membrane and into the cytoplasm. The plasmid DNA then makes its way into the nucleus but doesn't integrate into the genome. That's why it is rather inefficient. Viruses on the other hand go down railroads by hijacking the cytoskeleton and ultimately integrating into the host cell's genomic DNA. Commonly used viral vectors do not produce efficacy after repeated administration and are therefore not suitable for the multiple treatments that a lifelong disease such as CF needs. However, we now have some promising data on a novel lentiviral vector that can be given repeatedly, and we hope to start a first-in-man trial next year.

You have a role in Genomic England's 100,000 Genomes Project. Tell us more.

That project was formally launched by the Government last year and aims to sequence 100,000 whole genomes from NHS patients by 2017, with the goal of being to understand the differences between people's genetic code that leads to disease. I lead a national grouping which aims to help the interpretation of these findings in respiratory patients. It's an important step but also one with a greater opportunity. With all the sequencing activity going on, I think it would be sensible to link that not only to diagnostics but to a national gene therapy strategy. Once we can identify the underlying mutations in lots of rare diseases these may be amenable to gene therapy.

“There was never a moment's doubt that we would give it our best shot.”



100,000
genomes to be sequenced from around 70,000 NHS patients during the Department of Health's 100,000 Genomes Project

inside*

story

mini profile

Steve Michael

In 12 years at Imperial, Steve Michael has been a Security Officer, Fire Officer, and latterly a Postal Officer at the Hammersmith Campus. He is also a Corporal in the Army's Royal Corps of Signals Reserves.



How did you get involved with the military?

I was actually working at Imperial at the time and my route to work took me past the Royal Signals' Office Barracks in Lincoln's Inn Fields. I think I'd harboured an interest in the military for a while – it was always there – and curiosity eventually got the better of me and I simply wandered in and spoke with the Captain. After joining, I was hooked. I trained as an Army chef initially and later as a physical training instructor.

How much time do you have to give up?

It's mostly weekends on exercises. But I've also done a six-month operational tour of Cypress and a short tour of Gibraltar. For the most part it works quite well with my job at Imperial and people are reasonably accommodating. Before joining the reserves my fitness levels weren't great, but since then I've run three marathons and a triathlon for charity. I've also had chance to do things I never thought I

would be able to do like skiing and horsemanship for example. I'm in the 68 Signal Squadron (Inns of Court & City and Essex Yeomanry). When it was formed in the 19th Century its duty was to provide communications for a field army by means of visual signalling, mounted orderlies and telegraph. We still perform a ceremonial mounted duty at various parades including the Lord Mayor's Show in November, which I'll be doing for the 9th time this year. I also helped coordinate The Band of The Household Cavalry when they performed at Imperial Festival this year.

You were named Imperial's security staff member of the year in 2008. How did that come about?

I think it was largely because I was first on the scene of a very serious accident where a student was in a grave situation. I did what I could to help them based on what army medical training I'd done and waited for the emergency services to arrive. Thankfully the student survived.

Crick on the horizon for Imperial staff

The first Imperial researchers to take up attachments at the Francis Crick Institute have been announced.

Imperial is one of the founding partners in the Francis Crick Institute, a large interdisciplinary medical research institute based in London's King's Cross that will accommodate 1,250 scientists tackling health and disease challenges.

Research at the Crick will help us understand why diseases develop and find new ways to prevent, diagnose and treat illnesses such as cancer, heart disease, infections, and neurodegenerative diseases.

The other founding partners are the Medical Research Council, Cancer Research UK, the Wellcome Trust, University College London and King's College London.

The Crick's new building is due to open officially in early 2016 with several Imperial staff joining the institute on attachments, giving them the opportunity to collaborate with other world-leading biomedical scientists and researchers in related fields.

Below, three of the researchers involved with the attachments tell us more about the science that they will be carrying out and what they are looking forward to.

Professors Wendy Barclay (Medicine) and Peter Openshaw (National Heart and Lung Institute)

Professors Wendy Barclay and Peter Openshaw will be establishing an influenza hub at the Crick, bringing together expertise in molecular virology, immunology and respiratory disease.

Professor Barclay said: "The way the Crick building is designed to get scientists from different backgrounds to interact and make 'discoveries without boundaries' is a truly worthwhile philosophy, and the strong emphasis on public engagement also fits very well with our own thinking. We will be trying to understand why some influenza viruses, like H5N1 and H7N9 avian flu, make people so much more severely ill than others."

Professor Openshaw added: "I'm looking forward to getting to know leaders and groups at the Crick that work in areas that will complement our own, and hope that my knowledge of clinical medicine, pulmonology and the immunology of influenza will be useful to them."



Dr Gunnar Pruessner (Mathematics)

Dr Gunnar Pruessner will be the first Imperial academic to join the Francis Crick Institute on a sabbatical.

Eukaryotic cells – the cells that make up animals, plants and fungi – contain tiny rods called microtubules that transport molecules and materials within and between cells. On his year-long sabbatical, Dr Pruessner will be analysing these microtubules – which have an essential role in supporting the structure and function of normal, healthy cells – using statistical mechanics.

He explained: "An interaction between two proteins might be very simple, but when there are several of these simple interactions, the knock-on effects can be complicated. This is what we'll be trying to get to grips with in order to better understand how microtubules operate."





Professor Alan Heavens in the time machine DeLorean

Back to the Future

Imperial teamed up with the Royal Albert Hall on Saturday 4 July to celebrate the 30th anniversary of the 1980s film classic *Back to the Future*.

The film follows Marty McFly (Michael J Fox), a typical American teenager of the 1980s, who is accidentally sent back to 1955 in a plutonium-powered DeLorean 'time machine', invented by Dr Emmett Brown (Christopher Lloyd).

On a hot Saturday afternoon, between the matinee and evening screenings of the film with live orchestral accompaniment, Cosmologist Professor Alan Heavens (Physics) addressed a sold-out audience of enthusiasts on the subject of time travel.

He talked about the practicalities

of time travelling in a DeLorean, the paradox of affecting your present self by changing something in your past, and revealed which living human holds the record for the longest time travelled into the future.

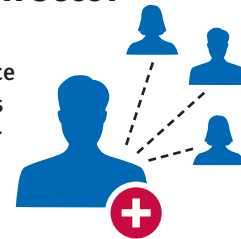
Asked when in time he would travel to in a time machine, Alan said: "I think I'd go back to the early 17th Century and listen to Claudio Monteverdi's music for the first time, I think that would be quite thrilling."

As for which historical person he's most like to meet: "It would have to be Einstein, couldn't be anybody else. I'd ask him how he came up with the idea of general relativity."

Listen to a full interview with Alan Heavens here: bit.ly/heavens-pod

Seize chance encounters says Facebook UK Director

Courageous people who take chance encounters are the best networkers said Steve Hatch, Regional Director of Facebook UK and Ireland, on a visit to Imperial last month.



He was talking to an audience of students taking part in the Entrepreneurial Smart Camp, which forms part of the Business School's Summer School.

In his talk, *The Magic of Networking*, Hatch outlined his 'seven seeds' for creating better relationships in the world of business. People who are 'connectors' for example, are passionate about bringing people or ideas together to create something bigger than themselves. He said forging a relationship with a connector is essential for helping people realise their full potential, either in life or at work.

"It's been a pleasure to visit Imperial, a world-leading university that encourages entrepreneurship and innovation across its many disciplines within business, science and technology," Hatch said. "I was inspired to meet the students and hope my presentation will help them to fulfil their future career ambitions."

Diane Morgan, Associate Dean of Programmes at the Business School said: "We were delighted to welcome Steve Hatch as a guest speaker at this year's Summer School. One of the objectives of the Summer School is to provide an intensive, but inspiring programme of talks and workshops to equip students with the knowledge and skills needed to thrive in today's world of business."

—LAURA SINGLETON, COMMUNICATIONS AND PUBLIC AFFAIRS

blog
SPOT

Student blogger Victoria : Bugs Day at Silwood

Recently I have been busy writing and submitting my early stage assessment – a report of what I have done so far in my PhD and what I plan to do next. So it was good to get a day out doing outreach at Silwood Park a few days after submitting. Silwood Park is Imperial's postgraduate campus near Ascot, Berkshire, with research and teaching in ecology, evolution, and conservation. One of my supervisors is based there, so I occasionally visit for



meetings and eventually will be going there to extract and analyse microbial DNA from my soil samples. This time I was visiting for the Grand Challenges in Ecosystems and the Environment (GCEE) *Bugs!* event which brought together Imperial researchers and local wildlife groups for a day of engaging visitors in research, bug hunts and pond dipping. I was exhibiting some of the invertebrates that can be found in

leaf litter, encouraging people to sieve them from the leaves and examine them under the microscope. Other stands had activities to extract DNA from strawberries, examine aphids and their predators and parasites and fossil insects. I had a really enjoyable day finished off with a BBQ.



More from Victoria and our other student bloggers:

www.imperial.ac.uk/utis/sites/studentblogs/



Student design innovations on display at the 2015 Imperial Show

From a sonar inspired headset to a smart exercise suit, the Imperial Show celebrated the best that student design has to offer the technology world.

The show, which ran from 7–9 July in the College Main Entrance, featured nearly 50 different devices developed by students on the Innovation Design Engineering (IDE) and Global Innovation Design (GID) courses – run jointly by Imperial’s Dyson School of Design Engineering and the Royal College of Art.

Professor Peter Childs, Head of the Dyson School of Design Engineering said: “We have an impressive heritage of design engineering at Imperial. Thirty-five years of our IDE course and two years of GID have created a community of more than 600 alumni. Every year we delight in seeing many of them realise their ideas and bring their innovative products to market.

“With this year’s founding of the Dyson School of Design Engineering at Imperial, the future looks brighter than ever.”



Sonna – one of the projects on display

→ From concept to reality



Happaratus

Morten Grønning Nielsen’s Happaratus is a power glove that can be used to sculpt hard materials like stone and wood by hand. Happaratus uses oscillating abrasive pads mounted onto the tips of the glove’s thumb, index and middle fingers, powered by an electric motor. Morten said: “Many designers and makers will tell you that the hand is the perfect tool for shaping and sculpting and now Happaratus gives the user the power to do it. The pads are flexible and you can make them in different shapes and sizes depending on the needs of the user. Happaratus can be adapted to everything from carving stone to restoring furniture.”



Bio Knit

Taking inspiration from nature, Bio Knit envisages a way of making single material products that can simultaneously adopt soft, flexible and hard textures by employing a combination of 3D knitting and heat-press technology. This way designers can both simplify the making process and improve recycling by eliminating the need for separating methods. Designer Ammo Liaos used the Bio Knit concept to develop footwear, explaining: “Around 330 million shoes are sold in the UK each year, each difficult to recycle due to the large amount of materials used in them. By using one multi-function material it saves both in production processes and makes recycling easier.”



Moya Power

Charlotte Slingsby has created Moya Power, to harvest small amounts of wind energy in a range of locations. Inspired by Slingsby’s native South Africa, where she says power-cuts are a frequent occurrence, Moya Power uses a number of finger-like filaments which are moved by passing currents of air, generating electricity. The filaments can also be adapted to architect’s designs to be used as a dynamic building façade. Charlotte said: “Moya is a low cost sheeting material used to generate power from abundant low grade wind energy that would otherwise go unused.”

—JON NARCROSS, COMMUNICATIONS AND PUBLIC AFFAIRS

long
service

Staff featured in this column have given many years of service to the College. Staff listed celebrate anniversaries during the period 1 June – 31 July 2015. The data are supplied by HR and correct at the time of going to press.

20 years

- Professor Alan Atkinson, Chair in Materials Chemistry, Materials
- Paula Brown, Group Administrator, Physics
- Lee Coulson, Laboratory Assistant, Medicine
- Carolyn Green, Secretary, National Heart & Lung Institute
- Dr Vassiliki Koufopanou, Research Fellow, Life Sciences
- Professor Anthony Kucernak, Professor of Physical Chemistry, Chemistry
- Stephanie McDevitt, Research Radiographer (PET), Medicine
- Professor Ann Muggeridge, Total Chair in Petroleum Engineering, Earth Science & Engineering
- Claire Parsonage, Clinical Trials Administrator, Medicine
- Magda Wheatley, Secretary, National Heart & Lung Institute

30 years

- Andy Pullen, Research Fellow, Civil and Environmental Engineering

40 years

- Charles Page, Senior Technical Consultant (Printing), ICT

50 years

- Trevor Beek, Technician, Physics

SPOTLIGHT

Charles Page, Senior Technical Consultant (Printing), ICT, 40 years



I joined St Mary's Hospital in June 1975, before which I was a Research Technician at Bedford College, University of London in Regent's Park, having graduating from there. My first job at St Mary's was Graduate Programmer in the Computer Unit before moving up to become Manager. I have therefore been involved for some considerable

time in both academia and computers – some of which are now relics in the Science Museum!

The merger of the West London Medical Schools with Imperial, following the merger of St Mary's with Imperial, was an interesting challenge as I attempted to integrate the computing environment in several disparate institutions with those at Imperial. This wasn't entirely a one-way process as we made a number of changes to the way things worked here in order to accommodate the requirements of others. This set us in good stead as the next project was to bring the many autonomous departments of Imperial together into a cohesive computing strategy led by ICT. One major project was developing and implementing the College's print network. We now have uniformity over 300 devices, running a truly managed print service whereas previously every department did its own thing with different payment mechanisms and worn out unmanaged printers. As a result of this work I've been invited to consult and present at industry conferences in Europe. All in all, an exciting time all the way through 40 years – especially working at Imperial where the only place to be is out in front.



Physics medals for Imperial



The Institute of Physics has recognised Jim Virdee for his leadership at CERN and Edmund Kelleher for his work on lasers.

Professor Sir Tejinder (Jim) Virdee has been awarded the Glazebrook Medal and prize, as one of the 'founding fathers' of the Compact Muon Solenoid (CMS) experiment at the Large Hadron Collider (LHC) at CERN, which, along with the ATLAS experiment, announced the discovery of a Higgs boson in July 2012. Professor Virdee also celebrated 30 years at the College in 2012 and was elected Fellow of the Royal Society in the same year.

"It is especially satisfying to be recognized by my fellow scientists. However, the long and arduous construction and data taking with the experiment has only been possible through the dedicated and painstaking effort of my CMS colleagues.

"Twenty-five years after the first drawings on a piece of paper, CMS is ready to extend the frontier of our knowledge once more and is now studying collisions at even higher energy, searching for signs of new phenomena, beyond the Standard Model of Particle Physics." (see pages 8 & 9).

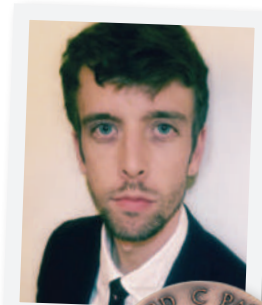
Meanwhile, Dr Edmund Kelleher (right) has been awarded the Paterson Medal and Prize, an Institute of Physics early career award for 'distinguished research in applied physics'.

He won the prize for his work on fibre lasers, which can make precise measurements of the distribution of electrons in new materials and so improve our understanding of the fundamental properties of matter. They can also aid advances in medical technology for the early detection, diagnosis and treatment of diseases.

"I feel particularly proud to have received this honour in 2015, as the UN has designated this 'International Year of Light and Light-based Technologies'. I will continue to do my utmost to contribute to shaping the future of photonic technologies, which I believe are making positive and tangible differences to our society."

The Glazebrook Medal was previously won by Imperial's Professor Steven Cowley in 2012 and by Professor Sir Peter Knight, former head of the Faculty of Natural Sciences and Deputy Rector (Research), in 2009. Previous winners of the Paterson Medal include Imperial's Professor Stefan Maier in 2010 and Professor Russell Cowburn (now University of Cambridge) in 2008.

— KERRY NOBLE AND SIMON LEVEY, COMMUNICATIONS AND PUBLIC AFFAIRS



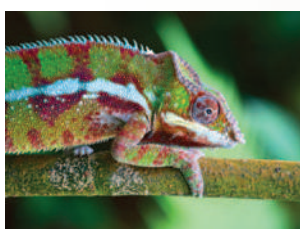


24 SEPTEMBER 17.00–20.00

Designs for life

The Imperial Fringe returns for the new academic year with a collaboration with London Design Festival and the Dyson School of Design Engineering. Meet the scientists and engineers applying design concepts to all

aspects of life, from eating and travel to communication and health. Get hands-on with their products and experiences at this evening of interactive workshops, displays and surprising encounters. A pay bar will be available throughout.



25 SEPTEMBER 16.00–22.30

Science Uncovered at the Natural History Museum

Meet more than 200 scientists and visiting experts presenting their research in the Museum's galleries. Part of European Researchers' Night, Imperial scientists will perform demonstrations of thermal sensing,

polarised light, camouflage and invisibility and will be running a variety of interactive exhibitions that demonstrate the different ways we and our animal cousins are able to manipulate the bright stuff!

take note

Don't delay!

Imperial staff and students are invited to a Procrastination Workshop run by the Central and North West London NHS Talking Therapies Service in conjunction with the Imperial College Health Centre. The two hour workshop will be held on Wednesday 9 September 10.00–12.00 at the South Kensington Campus and uses skills taken from Cognitive Behavioural Therapy.

To book call:
030 3333 0000



26 AUGUST 13.00

From battlefield to Bastion to Blighty 1914-2014: an extraordinary century of military medicine

Dr Emily Mayhew and Major Dafydd Edwards explore the advances made in battlefield medicine at the Imperial College Healthcare Charity annual lecture.

26 AUGUST 19.00

Science Museum Lates: Childhood

Imperial researchers present new research as part of the Science Museum's latest Lates evenings look at the science of childhood.



09 SEPTEMBER 13.00

Centre for Neurotechnology Research Symposium

Presentations and posters showcasing current neurotechnology research at Imperial.

09 SEPTEMBER 14.30

Climate-KIC UK Venture Competition 2015

Imperial researchers and alumni feature heavily amongst a line-up of nine UK start-ups tackling climate change who will take to the stage to compete for €20,000.



13 SEPTEMBER 11.00

The time-travelling operating theatre

Travel through time to learn about the changes in medical operations and the future of surgery from the Imperial College Centre for Engagement and Simulation Science.

21 SEPTEMBER 14.00

Section of Structural Biology launch

The Department of Medicine's newly established centre of excellence in Structural Biology, comprising structural biologists, cell biologists and clinicians will launch with a lecture given by Sir John Skehel.



Throughout the summer

21 AUGUST – 20 SEPTEMBER

The Floating Cinema 2015: Extra-Terrestrial

Explore outer space through an intergalactic programme of films and events across London's waterways, co-curated by Imperial theoretical cosmologist Dr Roberto Trotta. Screenings of sci-fi cult classics, a summer space school and a series of on-board talks bring together scientists, writers, thinkers and enthusiasts.

UNTIL SEPTEMBER

London Art Trail: What's in your DNA?

See unique DNA inspired double helix sculptures at South Kensington tube station and Royal Albert Hall, then head over to Christies to buy one as part of Cancer Research UK's campaign to raise awareness and funds for the Francis Crick Institute.

UNTIL 5 SEPTEMBER

Travel photographer of the year exhibition

Pop into the Royal Geographical Society to see the globe through award winning photography.



UNTIL OCTOBER

Royal Albert Hall Grand Tours

Explore the Royal Albert Hall and its history with these one-hour guided tours running throughout the summer.

Stay in the loop

✉ Visit www.imperial.ac.uk/events for more details about these events and others. To sign up for regular updates about Imperial events please email: events@imperial.ac.uk

