A new space race

Following the first ever comet landing, hear about some of Imperial’s other space-related activities

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Global energy cooperation needs urgent reform, say researchers

China and other developing nations must play a larger role in global energy governance, according to senior UK, Chinese and US energy experts. A committee, led by Lord Browne of Madling in the UK, along with senior Chinese and US experts called for world leaders to act now at the G20 summit in Brisbane on 15 and 16 November to commit to energy governance reform that is more inclusive of developing nations. The committee was set out in the Grantham Institute at Imperial, together with China’s Energy Research Institute (ERI) of the National Development and Reform Commission (NDRC). Energy policy experts at these two institutions have published a report, “Global Energy Governance Reform and China’s Participation”, alongside the committee’s statement.

“Our magnetometer sensor on the Rosetta orbiter, which measures the magnetic field around the comet, could be compared with the magnetometer sensor on Philae,” he said. “The end this information turned out to be really crucial to diagnosing the rotation of the comet. It was an additional way of understanding the comet’s spin.”

Rosetta and the RPC specifically will now investigate the plasma environment around the comet, and how this interacts with the solar wind — the charged particles that currently stream from the Sun. The comet’s plasma derives from vapourised volatile compounds that are ionised by solar ultraviolet radiation. The plasma density will increase as it makes its approach.

“The comet comes closer to the Sun, the science gets more and more interesting from a plasma point of view. However, we’ve already started to see some unexpected data, for example low-frequency waves of around 20 Hz, which were not predicted in the magnetic field, which we can’t explain at present.”

The Rosetta orbiter mission will continue until the comet reaches its perihelion — its closest point to the Sun — in August next year. The RPC team will test that their prediction of the comet’s ionosphere environment eventually defecates the solar wind.

Micro-machining laboratory opened

A £4.4 million mini-factory for developing the next generation of miniaturised medical devices and robots was officially opened at Imperial last week by President Alice Gast and Dr Lesley Thompson, Director of the Engineering and Physical Sciences Research Council (EPSRC).

The EPSRC Micro-Machining Facility for Medical Robotics will be led by Professor Guang-Zhong Yang, Director of the Hamlyn Centre. The new facility will provide a national hub for academia and industry in the UK for developing a range of miniaturised surgical robotic systems that improve the diagnosis of diseases, minimally invasive procedures and drug therapies for patients. Professor Guang-Zhong Yang said: “Systematically we are already in the process of developing a range of miniaturised medical robots and smart surgical devices that improve the way ailments that are cared for. Thanks to the foresight of the EPSRC, this new facility will speed up and improve development and production processes not only for the Hamlyn staff but also for researchers across the College and at other institutions.”

To develop miniaturised surgical robotic devices in the past, researchers at the College had to undergo a prolonged and costly design and construction process that involved getting parts made off-campus by a range of suppliers, which could take weeks and often months. The new facility brings the design and construction process in-house, which could cut development time down significantly.

There will be 3D printers for making components down to the nano-scale, imaging technology that will enable the researchers to see in real-time the tiny components they are working on and a micro-machine assembly line.

An Imperial team has received a distinguished award in a global competition and received £50,000,000 prize money after creating a device that analyses the body’s sounds to detect illnesses.

The GUES team from the Department of Electrical and Electronic Engineering were one of five runners up in the $2.25m XPRIZE Nokia Sensing XCHALLENGE, and were the only UK based team. The international competition aimed to develop an additional way of understanding the comet’s spin. It will be used to pump out heating and cooling. Once the system is operational, it will have a useful lifespan of 50 years. Work has begun on drilling a hole 227m below ground, could be 70m below ground, could be used to support the construction of the Hub, and will be designed by architects Allies & Morrison.

The researchers have developed a wearable, wireless device, the approximate weight of a pound coin, which sticks onto a person’s neck to detect sounds emanating from the heart and respiratory system. AcuPebble uses advanced algorithms to sift through a range of sounds to determine parameters that may indicate deteriorating health or illness in patients.

Team leader Dr Esther Rodriguez-Villegas said: “The response to AcuPebble has been overwhelming. We’ve had people writing to us from the five continents, telling us how much they love the technology. This competition has shown us just how important it is to get potential customers into the market as quickly as possible, where it will have the most benefit to society. We can’t wait to get started on the next steps to make this a reality.”

An Imperial Gues team (in white t-shirts, from left to right): Gao Li, Guangwei Chen, Esther Rodriguez-Villegas, Syed Anas Imtiaz received $120,000 in prize money for developing a device that detects illnesses.

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Health device propels Imperial to international success
Imperial champions women’s leadership

Imperial celebrated the successes of women in science and business at an event held on Tuesday November.

Titled Women’s Leadership in Entrepreneurial and STEMM cultures, the event brought together high-achieving women from across the higher education, business and the public sectors to share their personal career journeys.

Aiming to stimulate discussion about how to encourage female leadership, the event was organised by Karen Malusch (Centre for Environmental Policy), Lecturer in Environmental Law and Ambassador for Women in the Faculty of Law, Imperial.

Imperial’s Provost Professor James Stirling opened the event, recognising that “Imperial is committed to the Athena Swan programme – with all departments either holding awards or with applications in progress. New initiatives to promote, support and celebrate women in science are springing up all the time. These collectively impact on the culture of our institution, and make the College a place which appreciates and nurtures talent, regardless of gender.”

Business Jolly, Life Peer in the House of Lords and Government Whip, discussed the importance of craft in his profession. Professor Imperial surgeon has also emphasised the importance of craft in his profession. Professor

Craft lessons ‘vital’ for next generation

As a PhD student or postdoc, in thrill to lab to work and grant applications, it can be easy to forget that pursuing an academic career is seldom solely about the research, with a breath of opportunities available. Dr Arika Hall (Life Sciences) has a teaching-only position as a senior fellow at Imperial. Her responsibilities include course design, teaching, assessment and giving careers advice. Writing in Nature Jobs, Hall says she appreciates the rewarding nature of teaching, and says that, in terms of work/life balance, “teaching is much more liberating than research”.

Misleading advice for egg freezing

Lord Robert Winston (Professor of Science and Society at Imperial) writes in an open letter to The Times that recent advice by the American Society for Reproductive Medicine that women “freeze eggs early if [they] want to delay babies” is likely to mislead. “Women need to be aware that this does not appear to be a secure technology,” he writes. “In the UK just over 2,600 women have a total of more than 20,000 eggs frozen. Of these women 243 have had one or more of egg thawing and IVF, only 21 have achieved a pregnancy. The chance of success, even when young women freeze their eggs, appears to be well under 10 per cent.”

Illegal drugs could show way to better psychiatric meds

Studying potential positive effects of recreational drugs on mental wellbeing could help to unlock the pharmacology preventing much-needed psychiatric medicines from being developed, according to a former Government drugs tsar Professor David Nutt (Medicine). There is a crisis in the drug-discovery pipeline for mental health but one way of helping would be to collate the experiences of the many people who regularly use drugs on a recreational basis, he says in The Independent. “The drugs that we need to ease the burden of mental illness could be out there – we just need to look,” he says.

Prize-winning student innovators set to make a difference

The winning teams for the Faculty of Natural Sciences’ Make-a-Difference Impact Challenge Competition have been announced, with an idea for preserving milk and fruit juices at room temperature scooping the overall prize.

The competition, running for the first time this year, challenged all undergraduates in the Faculty of Natural Sciences to harness their creativity to develop solutions that could bring real benefits, under the theme ‘healthcare and well-being’.

The top three teams (see panel, right) were decided by the judges in June and were given access to facilities to develop their project to a proof-of-concept stage over eight weeks in the summer – each student receiving a bursary of £5,500 to cover their costs.

At an event on 28 October, the three teams presented their projects to an audience of judges comprising Lord Robert Winston, Professor of Science and Society at Imperial; Professor Sir John Pendry (Physics); Chair in Theoretical Nuclear Physics; and Professor Lesley Yellowlees, Vice-Principal and Head of the College of Science and Engineering at the University of Edinburgh.

Jiawen Dou, Elven Liu, Siija Yu and Qian Zheng devised a natural, low-cost method for preserving beverages like milk and fruit juices at room temperature developing an enzyme coated polymer that can be used in long-term storage.

Tim Pasewald and Vasdy Shenshin came up with a new design for an air displacement microchip – routinely used across all areas of bioscience research which is less prone to errors and demands less force from users’ fingers and hands, in theory decreasing the risk of repetitive strain injury when used for long periods.

Alan Chang, Timothy Yin Hou Hui, Tin Shing Lee and Xin Zhan employed synthetic biology techniques on a project to create a milk substitute to provide a lactose-free milk option to the public. The core objective of their project was to make milk affordable and readily accessible to everyone.

How to navigate an academic career

Pastimes such as knitting and jewellery-making are enjoying a resurgence, with a booming market in craft kits and home-made gifts. Yet the trend has not been mirrored in GCSEs. Now academics have warned of the disastrous impact it could have on British industries. An imperial surgeon has also emphasised the importance of craft in his profession. Professor Roger Kneebone (Surgery and Cancer) told The Times: “Of course you need a lot of scientific knowledge but you can cram your head full of facts more quickly than you can acquire the skills of a craft. The craft element is sometimes undervalued, and the gradual acquisition of its mastery.”

Endocrinologist recognised

Professor Graham Williams (Medicine) has won the Sidney H. Ingbar Distinguished Lectureship Award at the American Thyroid Association Annual Meeting in California. The first ever non-US winner, he was recognised for groundbreaking discoveries demonstrating the fundamental importance of thyroid hormones in the skeleton and their effects on bone and cartilage. This has built up a better understanding of bone biology and diseases such as osteoporosis.

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Smart material virtually eliminates arsenic from drinking water

Scientists have created a new material that can remove the double amount of arsenic from water than the leading material for water treatment. Arsenic is a toxic element found naturally in groundwater. Long-term exposure over a number of years to elevated concentrations of arsenate, the chemical form of arsenic in water, is associated with debilitating, and potentially fatal, illnesses including cancer, heart and lung disease, gastrointestinal problems and neurological disorders.

Scientists at Imperial have designed, tested and patented a new zinc-based material that can selectively bind to arsenate with domestic water filters and reduce the amount of arsenic that people are exposed to, in areas with known or suspected high arsenic content. Lead researcher Chris Mofitt (Earth Science and Engineering) said: “Our material has such high affinity that it is able to remove and ‘mop up’ the arsenic even when concentration levels are low. We hope that it could one day be easily added to water filters to make sure that when you pour a glass of water it is the cleanest it can possibly be, allowing you to control your arsenic exposure at home.”

The team point out that the work is at a very early stage and the estimated material costs per unit are higher than the current available materials. But when manufactured to scale they hope that given the efficiency of their technology, less material will be needed, making it price competitive, and possibly cheaper than existing products.

With funding from the Natural Environment Research Council (NERC) the team hopes to develop a mass market application for the sorbent.

QUICK FACTS

- More than 200 million people worldwide are unknowingly exposed to unsafe levels of arsenic in drinking water.

The chemistry

Adsorption, a process where atoms, ions, or electrically charged particles attach to a surface, is the most widely used method for removing arsenic from drinking water. Existing adsorbents, however, are not always selective in what they remove – by attaching lots of other chemicals in addition to arsenic, they can become clogged, saturated and ultimately ineffective. The researchers found a zinc-based chemical receptor attached to a “hard like” structure called HypoGel™ resin (allowing arsenic to be stripped from water samples) was highly selective and efficient in binding arsenate in a recent test solution. In fact, the zinc HypoGel™ resin had significantly greater adsorptive effect than currently used sands – particularly at pH values typically found in limestone aquifers used for drinking water.

Vital new insight into how we produce new brain cells

Researchers have identified a key mechanism in the birth of new brain cells, with implications for treating brain injury and diseases.

Neurogenesis is the process by which new brain cells are generated. It is known that the initial steps of neurogenesis involve neural stem cells dividing and specialising, but exactly how this is initiated and controlled is unclear.

The new study has revealed a crucial mechanism that keeps stem cells in a dormant state, preventing them from dividing or specialising. The hope is that if this mechanism can be blocked by medication then it could allow neural stem cells to develop into new neurons, providing a possible way to replace or repair damaged brain cells caused by brain injury, stroke or neurodegenerative diseases such as dementia.

Lead author Dr Simona Parniello (Institute of Clinical Science) said: “Until about 25 years ago it was assumed that we only possess the neurons that we are born with, but the discovery that neurogenesis continues into adulthood has opened up a very exciting area of research with important clinical implications.

“Neurogenesis is a bit like a production line, where neural stem cells become activated to proliferate and specialise and then migrate to different regions of the brain where they become mature functional neurons,” said Dr Parniello.

The fate of neural stem cells is strongly influenced by their surrounding micro-environment. For the first time, the researchers revealed an inhibitory process that occurs when stem cells are in contact with blood vessels, driven by two proteins in the lining of the vessels – endothelin and Jagged. The team say that agents that block the activity of these proteins represent prime candidates for therapeutic intervention, especially since the blood vessels are more accessible for intervention.

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Low birth rates bring economic benefits

Moderately lower birth rates can actually improve broader standards of living, according to a new global study.

In wealthy countries, including the UK, couples are having fewer babies or none at all, leading to widespread concern about ageing populations, declining tax revenues, high spending on pensions and healthcare, and possible economic decline.

The UK has a moderately low birth rate, 1.88 births per woman, which is considered to be a little below the replacement rate of two children per woman.

Some governments tend to favour higher birth rates, however, researchers from Imperial College Business School found that when public and private costs are taken into account, a moderately low birth rate can improve the overall standard of living, especially in wealthier countries.

The team correlated birth rates for 40 countries with economic data from the National Transfer Accounts project, which measures how people at each age produce, consume, and share resources and save for their future.

According to the study, published in the journal Science, a moderately low birth rate enables the families in wealthier countries to maintain their standard of living, even with an ageing population. The researchers explain that even if countries have to raise their taxes to pay for an increasingly older population, it is far less of an expense on the nation’s wealth than if people had to fund larger families, which ultimately costs the nation more.

Professor (Jim) Sefton (Business School) co-author of the report said: “Our study demonstrates that the UK’s birth rate is actually just right to foster overall prosperity. I hope the relevant governments will focus more on targeting policies to accommodate an ageing population rather than encouraging people to have more children.”

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Engineers demonstrate how heat can transmit data

Prototype technology that uses bursts of heat to transmit information over short distances has been developed by a team of engineers.

The researchers have created a low-cost, wireless communications technology that exploits black-body radiation in the infrared heat spectrum, which is currently used for thermal imaging.

This part of the spectral range is currently underused, and the team behind the technology believe it could provide a new form of secure communication that could be concealed in background noise, making it harder to intercept or jam using conventional technology.

The prototype consists of a transmitter with miniature incandescent tungsten bulbs that emit bursts of heat in patterns that encode information. This data is picked up by a receiver that filters out external interference to detect the information in the thermal infrared spectrum as it is transmitted and is then decoded by a silicon chip.

The researchers believe that their prototype could develop technologies such as wireless door entry systems so that information can be sent more securely to other devices in the future.

Inventor Dr Stefan Luxiczyn (Electrical and Electronic Engineering) said: “Code grabbing is a major problem for wireless door entry systems. For example, thieves are currently able to intercept information wirelessly transmitted from your key fob to your car’s door entry system, which they can then use later on to break into your car when it is left unattended. One potential application for our technology could see the development of a new type of key fob for cars that transmits data via bursts of infrared heat, which would be much harder to intercept by crooks.”

The next step will see the researchers upgrading the hardware so that it can transmit information at faster speeds over longer distances. Following that the team plan to integrate the technology into one complete system, which will be miniaturised into handheld applications like smart phones or door entry smart key fobs.

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698,512 babies were born in the UK in 2013, down from 729,674 in 2012

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| SCIENCE ROUNDUP – COMMUNICATIONS AND PUBLIC AFFAIRS |
**The new space race**

The private and government-backed UK space sector is set to quadruple in size by 2030 and Imperial is aiming to get in on the action.

Some people would have you believe that the pioneering spirit that put a man on the moon in 1969 has been lost in the past half century. Although piloted missions have proved prohibitively costly and dangerous, you could conversely argue that we’re in a golden age of discovery – for example uncovering amazing and possibly life-harbouiring worlds such as Saturn’s moon Enceladus and most recently chasing down, then landing on, comet 67P (while zipping along at a cool 135,000 kilometres per hour).

Both these respective missions, Cassini and Rosetta, have had key experiments and technology build and designed here at Imperial. Indeed, the College has one of the largest, and longest running space ‘harbours’ in the UK – dating back to Imperial’s involvement in the Ariel satellite missions of the late 1960s. Traditionally though, the College’s space research groups have tended to operate quite independently – dispersed across a number of departments. But with the £6 billion UK space sector projected to grow to £12bn by 2020, spazzheaded by the UK Space Agency, there’s a need for more collaboration both internally and externally.

That’s the thinking behind the Imperial SpaceLab, new in its second year, which gathers 140 researchers across all three faculties and the Business School.

Director of the SpaceLab Professor Steve Schwartz (Physics) says: “The space research that we carry out is partly about the wonder of space and understanding the universe, but it also brings benefits here on Earth. When scientists, engineers, industry and government collaborate on space research great things can happen from weather forecasting and GPS navigation to medical diagnosis.

“SpaceLab is about reaching out across different academic departments and scientific disciplines, as well as industry, to come together, do something different and see what wider impacts our research might have.”

**We take a look at three SpaceLab researchers making an impact.**

**Health Tips from Zero-G**

Working at the interface between medicine and space is Dr Richard Abel, Lecturer in Musculoskeletal Sciences in the Department of Surgery and Cancer. Having gained a PhD in palaeoanthropology and comparative anatomy of monkeys before working in the mineralogy department at the Natural History Museum, Richard is accustomed to crossing boundaries.

Around a year ago he became interested in physiological conditions that affect astronauts who spend several months at a time in the weightlessness of space – namely bone degeneration similar to osteoporosis on Earth and eye and vision problems with parallels to glaucoma.

“Once you start to understand some of the mechanisms that lead to illness in astronauts, or lead to illness on Earth, you can extrapolate across and work out what’s really going on in both – revealing the bigger picture.”

Osteoporosis is chiefly caused by diminishing sex hormones, which are required for bone maintenance. Conversely, bone weakness in astronauts is chiefly caused by lack of impact-based exercise and loading.

“We know that somehow, loading works in concert with the sex hormones to maintain bone, but we don’t quite understand how. Engineers, if they want to understand how a system works, they will remove or break it part of it. Studying astronauts’ bones presents that opportunity because they cannot exercise with impact, only resistance.”

Richard is also looking at glaucoma, a condition caused by a build-up of pressure inside the eye, disturbing the optic nerve and in some cases leading to vision loss. Something similar can happen to astronauts who spend time in space but as a result of pressure decreases.

Working in collaboration with researchers at Georgia Institute of Technology in the USA, Richard has been performing high resolution CT scans of donated eyes whilst subjecting them to different levels of internal pressure in a special experimental set-up at the Diamond Light Source Facility in Oxfordshire. Ultimately he’s aiming to build-up a dynamic three-dimensional computational model of a key part of the eye, which will help them to develop new diagnostic tools and treatments for terrestrial and extra-terrestrial diseases.

**Market Insight … from space**

One exciting new area of SpaceLab research that cuts across the Faculty of Engineering, the Business School and Grantham Institute for Climate Change is led by Dr Enrico Biffis (Business School) – an economist who specialises in risk management and insurance.

In recent years he and his team became interested in how the increasing occurrence of extreme weather and climate events poses a global threat to various economic sectors such as energy, transport and food production.

“From an economic point of view, when there is a big hurricane or flood for example, it’s very important to have a quick estimate of what the losses might be because there’s a lot of insured value that is supported by limited capital or securitised and hence people try to trade out with hedging instruments.”

There are two main aspects to Enrico’s team’s work: one is to better understand the market repercussions of extreme weather in real time as events unfold and the other is to model future events in order to understand how certain mitigation strategies might for example make crop yields more resilient.

However, most current sources of data simply are not accurate enough in either spatial resolution or frequency to be put to good use for the rigours of economic modelling. Enrico’s team is investigating how integration of different data sources – geostationary satellite data, orbiting satellites and ground-based meteorological stations – can achieve better predictive models.

These models will also help when it comes to changing practices and procedures in an effort to protect against future shocks.

“Of course you can’t talk to every farmer, but by teaming up with producers you can provide the right incentives using the price of insurance as a way of convincing farming cooperatives to adopt new technology, change seeds or use different areas for cultivation. That can create a lot of value in terms of resilience in the market. But you need good information to do it.”

**Busting fraud with supernova**

While the previous two academics featured were examples of non-physicists finding new avenues in space research or uses for space data, Dr Roberto Tria (Physics) is a cosmologist through and through. One of his research areas focuses on supernovae – specifically how studying these stellar explosions can help map the expansion of the universe.

“We use them as signposts, to work out how the expansion of the universe changes with time. That in turn is influenced by what the Universe contains,” explains Roberto.

“The ever increasing rate of expansion suggests that three quarters of the Universe is made of a mysterious form of energy, called dark energy.”

The real challenge is in interpreting the vast quantity of data, and in discerning whether certain patterns represent something cosmologically interesting and ‘real’ – or just background noise.

Roberto is now applying analysis methods used for supernovae to the detection of fraud in the consumer banking industry, flagging up when customers’ details might be being used nefariously.

There is a great variability in consumer transactions and most transactions are perfectly fine. But if you haven’t seen a certain activity before how do you classify it? How do you pool your knowledge from other types of transactions in order to say something about that particular one for that potential customer at that time – and react quickly; you can’t mull it over for days!”

With funding from an EPSRC/ SFC impact acceleration grant, Roberto is now conducting a pilot study with a start-up company working with a major bank. It is a sensitive work that requires patience, but it could be the start of something bigger.

“I think the challenge for us at Imperial and the SpaceLab is to make sure that the outside world perceives us as being at the forefront of data science challenges...”

**The challenge for us… is to make sure that the outside world perceives us as being at the forefront of data science challenges...**
Consults, formerly known as Deans, are elected by professors, readers and senior lecturers from three Faculty constituencies to represent the views of the College’s academic community.

The three constituencies comprise of the Faculty of Engineering and the Imperial College Business School; the Faculty of Natural Sciences and the Centre for Co-Curricular Studies and the Faculty of Medicine.

Professor Richard Thompson, who is based in the Department of Physics, serves as Senior College Consult, following three years in the Department of Physics, Thompson, who is based in Engineering and the Imperial College Business School; the Faculty of Natural Sciences and Centre for Co-Curricular Studies. We caught up with him to find out more about the role of Consults at the College.

**What is a Consult?** Consults essentially act as spokespersons for Imperial’s academic community. We are elected by Faculty constituencies, and work to complement and broaden the expertise of senior College management by lending the perspective of teaching and research staff. Consults deliberately sit outside of the usual management structure to enable us to speak freely and provide impartial and independent viewpoints on a range of issues.

**What kinds of activities are the Consults involved in?** It’s a bit of a mixed bag! Much of what we do involves ensuring that academic standards of excellence are upheld consistently across all Faculties and that appropriate processes are followed. Consults are trusted to act fairly and with integrity, and we are often parachuted in to help with tasks that require impartial judgement, such as disciplinary issues or student appeals.

**What does your new role as Senior Consult entail?** It’s not substantially different to that of my fellow Consults, actually! I’m here to serve in a representative function for the group as a whole when required, but am involved in much the same activities as the others.

**Why did you decide to put yourself forward for the role of Consult?** I was attracted to the prospect of doing something that would make a difference at the College, and which would bring real benefits to both staff and students. The role also offered a unique insight into the way that the College as a whole operates. As well as being incredibly interesting, this provides a useful perspective to take back to my own research and teaching work. It is an enormous privilege, and very affirming, to be trusted by my colleagues to represent them in this way.

**What aspect of the role do you enjoy most?** I find contributing to academic promotion panels particularly fulfilling. It is a decision that has the potential to change a person’s future, and having a hand in that – especially when it leads to a positive outcome – is extremely rewarding.

**Sage advice: shedding light on the role of Imperial’s Consults**

**The ongoing pain of war**

With recent military campaigns in Iraq and Afghanistan, we’ve become reacquainted with the terrible consequences of war – brought into stark focus with the number of amputee veterans of those conflicts.

It was a similar picture a hundred years ago, in the First World War – but on a far larger scale with 40,000 surviving amputees. The comparison is highlighted in a paper published in The Lancet this month by Dr Emily Mayhew, a medical historian at the College; pain specialist Professor Michele Dougherty (Surgery and Cancer); and army surgeon Major Charles Edwards, also a researcher at the Royal British Legion Centre for Blast Injury Studies at Imperial.

The researchers delved into the archives of the same journal to explore how amputation-related pain was understood and treated by surgeons on the Western Front.

“Although surgeons worked very hard to understand and resolve the chronic pain problems that many amputee patients faced, they really weren’t able to get to grips with them,” Dr Mayhew says.

During the Battle of the Somme in 1916, Marmaduke Sheild, a senior consulting surgeon who treated many military casualties after they returned to England, wrote that post-amputation pain was “a source of intolerable suffering to [his amputee patients], and of despair to those who fit them with artificial limbs.” He later called for surgeons not to use the guillotine method, reporting that it left nerves exposed, causing both stump pain and poor prosthetic fit.

Today, instead of resorting to amputation in the first instance, surgeons use a technique called debridement to remove soft tissue, preserving as much of the limb as possible. Surgeons are part of a multidisciplinary team involving specialists in pain medicine and rehabilitation.

There was very little discussion in the archives pertaining to the pain that amputees felt in their missing limbs – known as phantom limb pain – possibly because surgeons were helpless to do anything about it.

The condition is now understood to be a consequence of how the nervous system adapts to damaged nerves and the loss of a limb, and affects around 50 per cent of amputees. However, it is still poorly understood and difficult to manage.

Major Edwards said: “Even now, we’re not entirely sure what the right answer is. There isn’t one answer for everyone; it’s a tailor-made modality of treatment for each casualty. That’s a long departure from 100 years ago, where the chronic pain of amputation was almost brushed under the carpet.”

― Laura Gallagher, Communications and Public Affairs

**Mini profile**

**Michele Dougherty**

Professor Michele Dougherty is leading missions to Saturn and Jupiter and has recently been appointed as Research Professorship by the Royal Society.

How did you come to work in space physics?

I never thought I’d end up in this field because I didn’t do science at school – I went to an all-girls’ school in South Africa and it wasn’t usual for girls to do Physics in those days. But I was quite good at Maths and so I persuaded the university to let me do a BSc. When I came to Imperial, a few years after finishing my PhD, I was asked to spend a little bit of time putting a magnetic field model together to look at Jupiter and eventually took over as Principal Investigator on the magnetometer instrument on Cassini.

What have been the best moments of your career so far?

There are two, both linked to the Cassini mission. The first was when we all went to the Jet Propulsion Lab in California to watch the spacecraft when it first went into orbit around Saturn, six and a half years after it had launched. The second was discovering the atmosphere on one of Saturn’s moons. Observations from two flybys suggested an atmosphere but we weren’t sure. So on the next flyby we persuaded the project team to take the spacecraft really close, at 15nm away from the moon’s surface. I watched the data coming back with my heart in my mouth because if we had messed up no one would have ever believed me again!

What are you looking forward to doing over the ten years of your Royal Society Professorship?

I am looking forward to having the time to do research, although I love teaching. I think the scariest thing I ever do is teach. 250 undergraduates, but I will miss it. Cassini has another three years to run, and then the spacecraft will burn up in the atmosphere of Saturn. We’ll get really close and be able to measure the internal planetary field, something that we don’t yet understand.

― Sam Wong, Communications and Public Affairs"
Re-righting wheelchair technology developed by students

Anyone who has seen wheelchair basketball and rugby will know how fast, exciting and furious it can be. Now a new assistive technology developed by students from Imperial College could increase the tempo even more by enabling players to re-right their wheelchair after a crash, thereby minimising stoppages.

In wheelchair basketball and wheelchair rugby, players can crash into one another and tip over onto the floor. Players are strapped into the wheelchair and often have the ability to move it into a frontal position, but find it difficult to push the wheelchair upright because of the way these wheelchairs are currently designed. The Imperial team has developed a device that enables players to push their wheelchairs into an upright position. They have augmented the front bumper section of a sports wheelchair and inserted a metal wheel with rubber casing and a clutch mechanism into the frame. This provides a lockable pivot point between the wheelchair’s bumper and the floor so that a player can push themselves up from the floor and re-right the chair and resume playing.

The students have already trialled their augmented sports wheelchair with members of the London Titans wheelchair basketball team. The Imperial team consists of Jacqueline Beddow-Rosendo, Bianca de Biasi and Simone Castagno. This project is part of the five-year Rio Tinto Sports Innovation Challenge, now in its second year.

Simone Castagno said: “We want to empower players who compete in wheelchair sports, so that they don’t have to rely on others to get them upright and back in the game. Ultimately, we hope to see our device being used by sportspersons in the near future.”

“Speed up the process, as a philanthropic gesture, the team is approaching manufacturers of sports wheelchairs and offering their technology for free.”

—COLE SMITH, COMMUNICATIONS AND PUBLIC AFFAIRS

See a video demonstration of the technology: bit.ly/pivottech

School meals made healthier with new planning tool

An innovative free school meals planner developed at Imperial is improving the nutritional intake of millions of school children.

The tool supports the planning of nutritionally balanced and fully cooked school meals using locally available food.

Developed by Imperial’s Partnership for Child Development (PCD) and trialled by the Ghana School Feeding Programme, the School Meals Planner was unveiled at the Global Child Nutrition Forum in 2014 in October.

‘Creating a nutritionally balanced school menu using local supplies is not an easy thing to do, especially when you are working within a tight budget,’ said Dr Lasley Drake, Executive Director of the PCD at Imperial. ‘This is doubly true when the children relying on your school meals are from communities where food insecurity is high and malnutrition and anemia are common conditions.’

The tool, which is available both online and offline, employs gingerbread men to show visually if a meal is meeting the recommended daily intake of nutrients as identified by the UN’s Food and Agriculture Organisation and the World Health Organisation.

By linking local market prices for the ingredients, the planner shows the user the actual cost of each meal. With this information, programme managers are able to create accurate and realistic school meal budgets. The school meals planner also works as an information source for smallholder farmers, so they know what foods to supply to schools, and as an educational resource for schools to teach children about healthy eating.

The Ghana School Feeding Programme is using the tool to plan meals for some of the 2.6 million schoolchildren fed by the programme every school day. Victoria Kuma-Mintah, from the Ghana School Feeding Programme, said: “One of the strengths of PCD’s meal planner is that it allows us to select nutritious local dishes using local ingredients which we know our farmers are producing.”

Following the success of the School Meals Planner in Ghana, the tool will be rolled out in other countries to ensure that millions more children are able to enjoy healthy and nutritious hot school meals.

—FREDDIE PRILL, SCHOOLS OF PUBLIC HEALTH

Local school students turn science buskers at Imperial

More than thirty school students gathered in the Wohl Reach Out Lab last month to show off their science skills to the Imperial community.

In sessions led by Imperial Physics alumnus and science-performer Niall Montay, Year 7 students from Westminster Academy were tasked with coming up with posters and performances to demonstrate scientific concepts in an engaging way. The students then put these to the test in an hour of “science busking” attended by Imperial staff and students.

The science busking activity forms part of a new long-term engagement programme with Westminster Academy and its primary feeder schools, funded by College alumni and Westminster Academy sponsor David Ganger.

The programme will fund 30 days of activity in the Wohl Reach Out Lab for the school each year for the next five years and will involve students across all year groups – from the school’s associated primary schools up to its sixth form classes.

Westminster pupil Daniel Goldfield explained how carbon dioxide extinguishes flames by conducting an experiment using dry-ice (frozen carbon dioxide), water and candles. Daniel said: “I’ve had a fantastic time learning about science and thinking about how best to share my new knowledge with other people. I always think that you can achieve anything as long as you try hard enough and today proves that – we’ve learnt such a lot in a short period of time and now we’re teaching others about it.”

Annalisa Alexander, Head of Outreach at Imperial, said: “We are delighted to see how these pupils rise to the challenge of our Science Busking Day. The lab has been buzzing with excitement and it was fantastic to hear the groups explaining their experiments to the audience with such eloquence and enthusiasm. The key to most of our work in the Wohl Reach Out Lab is hands-on practical; children learn best when they are engaged in and excited by what they see and do.”

Students were tackled with coming up with posters and performances to demonstrate scientific concepts.

—MAXINE MYERS, COMMUNICATIONS AND PUBLIC AFFAIRS

“...I’ve had a fantastic time learning about science and thinking about how best to share my new knowledge with other people.”

Daniel Goldfield, Westminster pupil
Exhibition highlights the history of College homepage

A recent exhibition in the Blth Gallery looked back over seven years of Imperial’s past homepage designs. Peter said: “The College homepage has evolved over time to achieve its current form. Our aim is to create a visually appealing and engaging site that encourages users to explore the College’s resources and services.”

The current homepage has been in place since 2007 and has been viewed over 70 million times since then. Having featured almost 1,500 images and more than 870 accompanying pairs of words, the homepage has helped Imperial tell some of its most exciting stories – including cutting edge research, outstanding student achievements, exciting stories – including cutting-edge design of each homepage. We want to capture the perfect picture and pair of words for each homepage design.

Peter said: “A lot of thought goes into the design of each homepage. We want to capture the richness of our community and give a true flavour of what makes Imperial to feature stories from all corners of the College.”

The current homepage will be retired on 8 December as the two-year project to review and redesign Imperial’s website begins its roll-out. Peter added: “The current website, launched in 2007 as the second major iteration of the College homepage, has served us well but technology has moved on a lot since 2007. People are now accessing the website from many different kinds of devices. Peter said: “What works well on a computer won’t necessarily be right for a smartphone or a tablet. The new design will be more responsive and content will move and rearrange on the page to best fit the screen size and device the user is accessing the site from.”

Jeanne D’Souza: Communications and Public Affairs

Find out more about the Web Redesign Project at imperial.ac.uk/redesign

obituaries

John Westcott

John Westcott (Electronic and Electrical Engineering, Emeritus Professor of Control Systems, died on 10 October, shortly before his 94th birthday. His college from the Department, Professor David Payne, pays tribute.

John’s route into academia was a rather unusual one. Having won a university scholarship, he decided, on the advice of his father, to instead serve as an apprentice in the electronics industry.

The Life of the College Homepage showcased over 800 of Imperial’s past homepage designs. Peter said: “The College homepage has evolved over time to achieve its current form. Our aim is to create a visually appealing and engaging site that encourages users to explore the College’s resources and services.”

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Jeanne D’Souza: Communications and Public Affairs
Brain health: it takes more than pills and potions (live-streamed lecture)

Watch this sold-out inaugural lecture live online and learn how the lives of Parkinson's and Alzheimer's patients could be transformed by neurotechnology and new concepts for treatment. Professor Paul Matthews is Edmond and Lily Safra Chair in Translational Neuroscience and Therapeutics and Head of the Division of Brain Sciences. Watch at http://bit.ly/brainhealth_lecture and follow on Twitter @brainhealth

How the genomics of TB is changing our view of the human immune system

Up to two billion people may be infected with tuberculosis (TB), according to the World Health Organisation. Why are some people able to live unaffected while 1.5 million others die from the disease each year? Professor Anne O’Garra (National Heart and Lung Institute) uncovers the science of transcriptomics and how our understanding of immunity is evolving with the help of TB bacteria, at her inaugural lecture. Follow on Twitter #TBgenomics

20 NOVEMBER, 18.00
Biomechanical approach to lymphedema
Hear how engineering can fix the body’s plumbing, with Professor James Moore Jr (Bioengineering), at this live-streamed lecture from the Lymphatic Education and Research Network.

21 NOVEMBER, 19.30
Bette Davis on the edge
A solo theatre performance by Christine St John, with proceeds supporting liver, digestive and gut health research through the Imperial College Healthcare Charity.

22 NOVEMBER, 10.00
London Climate Forum 2014
Student-led conference, with presentations from the UK’s leading climate scientists and analysts, including Professor Sir Brian Hoskins (Grantham Institute).

26 NOVEMBER, 11.30
Working in partnership: opportunities and challenges
Opportunity for staff to discuss research priorities with Professor Philip Nelson, Chief Executive of Engineering and Physical Sciences Research Council (EPSRC).

24 NOVEMBER, 16.30
The 100,000 Genomes Project and Genomics England
Dr Clare Turnbull, Institute of Cancer Research, discusses opportunities for researchers to get involved with upcoming genomics projects.

26 NOVEMBER, 18.00
Linking climate science with policy relevance
Professor Jim Skea (Environmental Policy) analyses the policy issues countries face in tackling global climate change, following the recently published IPCC Synthesis report from the UN.

27 NOVEMBER – POSTPONED
Asthma and allergy in Europe
Inaugural lecture of Professor Debbie Jarvis (National Heart and Lung Institute) will be rescheduled, please see website for updates.

27 NOVEMBER, 13.00
Lunchtime concert
Tippett Quartet performs Janacek’s String Quartet No 2 ‘Intimate Letters’, with narration.

1 DECEMBER, 16.00
HIV in 2015: on the edge of a revolution?
World AIDS Day discussion with experts Dr Roger Tatoud, Dr Goli Haidari and Lauren Reilly (all Medicine). This Disability Awareness Month event is organised by Able@ Imperial and Imperial 600 staff networks.

4 DECEMBER, 17.30
Multi-parametric programming and control
Professor Stratos Pliakopoulos (Chemical Engineering) delivers the Twenty first Professor Roger W H Sargent Lecture.

10 NOVEMBER, 18.00
Biomechanical approach to lymphedema
Hear how engineering can fix the body’s plumbing, with Professor James Moore Jr (Bioengineering), at this live-streamed lecture from the Lymphatic Education and Research Network.

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How the genomics of TB is changing our view of the human immune system
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10 DECEMBER, 12.30
Postgraduate Open Day 2014
Information afternoon for anyone considering postgraduate study at Imperial.

11 DECEMBER, 17.00
The beginning of life
Fertility expert Professor Lord Robert Winston delivers the annual children’s Christmas demonstration lecture for 11-16 year olds.

11 DECEMBER, 17.00
Festive Fringe 2014
Set your festive spirits alight as Imperial Finge returns for a seasonal celebration of research. Come take part of hands-on demos, activities and games in the College Main Entrance. Drop in all evening and wet your whistle at the festive Fringe bar.

17 30 NOVEMBER
09.00 – 20.00
The people who are keeping me alive
A Cancer Research UK portrait exhibition in the College Main Entrance by Rina Dave, a cancer patient, showing the people behind her treatment and support.

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Kelly Gleason (Surgery and Cancer), Senior Research Nurse

What are you doing in the picture? I'm sitting for a portrait photography project called 'The people who are keeping me alive' [see listings to left] devised by a cancer patient of ours, Rina Dave. She chose sunflowers as a prop after noticing that I often have flowers at my desk. It's very rewarding to help someone realise their creative aspirations, and it's been a delight supporting her.

What would you do if you were editor of Reporter?
I would turn the spotlight on the research groups that take findings from the lab and turn them into treatments for the clinic. It's so important for clinicians to work closely with scientists on research that matters to patients and to shorten the time it takes to develop new treatments.

Would you be your cover star?
The research nurses who plan and manage clinical trials. They work so hard to carry out high quality research while keeping patients at the heart of all they do. They are the engine that makes research happen in our AHSC and they are crucial to the success of our clinical research.

Want to be the next reader featured in Reporter? Send in a picture of yourself to reporter@imperial.ac.uk

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