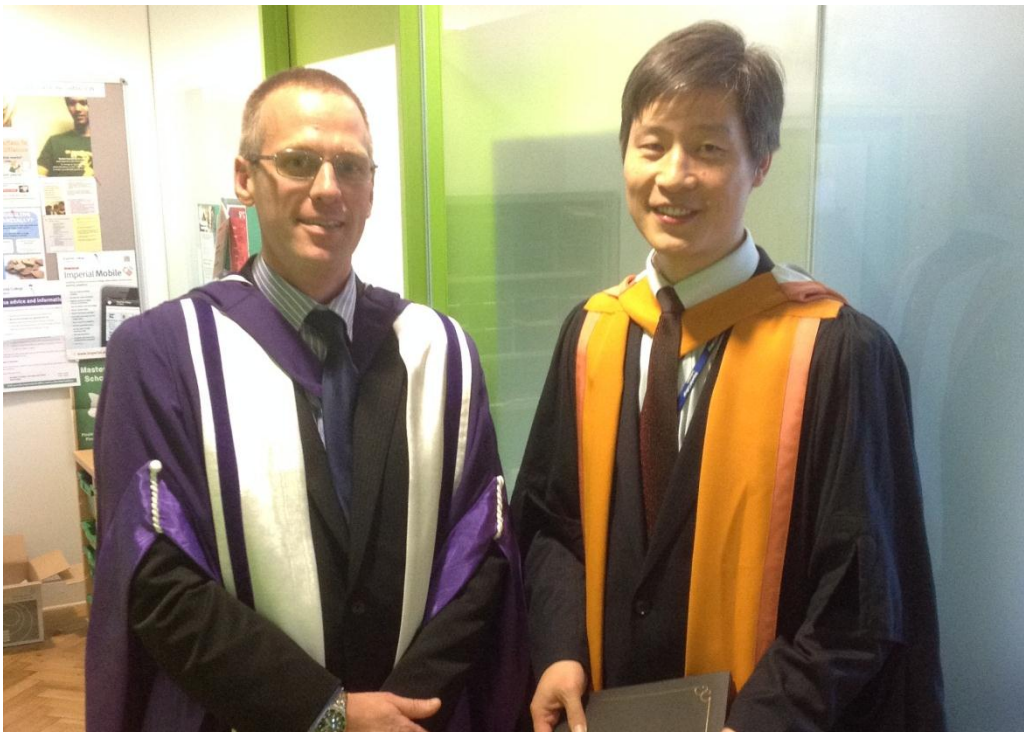


Bioengineering Newsletter

October 2013

Volume 7 Issue 10

THE LEADING DEPARTMENT OF BIOENGINEERING IN THE UK

What a month!

by Jenna Stevens-Smith

October has been quite a month for the Department. We had a visit from Royalty, a legendary footballer, two Paralympic athletes, the engineering accreditation board and our undergraduate graduation.

I cannot help but feel the huge sigh of relief from staff now that REF and accreditation are complete for another five years. For those who are unsure of what REF (Research Excellence Framework) and accreditation are all about go to page 8 for more information.

The Department has also had some good media coverage this month including HRH Prince Harry's visit to officially open The Royal British Legion Centre for Blast Injury Studies, the Imperial iGEM team were on Adam Rutherford's Inside Science BBC Radio4 programme and Dr Michelle Rogers's TEDx talk went live, you can watch Michelle talking about Traumatic Brain Injury **here.**

At the beginning of the month bioengineering took over the main entrance of Imperial with the weeklong Rio Tinto Sports Innovation Challenge exhibition. With special events throughout the week, the students presenting their projects and prototypes were a real credit to themselves and the Department. I was especially impressed with their ability to communicate with a wide range of audiences, from Paralympic athletes to potential students, representatives from industry and sponsors.

From innovation to funding, and this month Government pledged £400million (in real terms £200million as it is matched funding) to encourage women in engineering initiatives. This includes investments in national infrastructure, world class facilities and teaching for students. The fund will be administered by the Higher Education Funding Council for England (HEFCE). Supporting women in engineering is something the Department feels strongly about and we welcome suggestions for ways we can improve and additions to the new programme of the women's network events.

To conclude this editorial I want to focus on the future 'Tomorrow's Engineers' to be exact. Next week (November 4-8) is Tomorrow's Engineers week, an initiative based at Engineering UK. They work in partnership with the different Professional Engineering Institutions to help raise the profile of engineering, engineering careers and pathways into engineering to 5-19 year olds. For more information about Tomorrow's Engineers, their programmes and resources check out their **website.**

IN THIS ISSUE

Royal Visit

HRH Prince Harry officially opened The Royal British Legion Centre for Blast Injury Studies on Thursday 17th October lots of photos and reports from this event.

Page 7

Making an impact

The last Research Assessment Exercise was in 2008 the results for the new assessment will be announced in 2014. But why these assessments are important and what the results mean for the Department.

Page 8

Careers Corner: Networking

by Yasmina Mallam-Hassam

Networking for Success

There are common misconceptions about networking, such as that it's difficult and only works for charismatic personalities who are good at schmoozing, or is basically a process for asking influential contacts to give you a job. Wrong. Networking is all about creating a mutually beneficial web of relationships, which allow you to refine your career ideas and help you find suitable opportunities. Simply, it involves connecting with professionals in your field of interest to learn more about sectors, career options, and potential vacancies.

Make the most of campus events

Networking with employers couldn't be easier on campus, where a wide range of careers talks, skills sessions, presentations, fairs and forums are organised by the Department of Bioengineering and the Careers Service. Employers are actively targeting Imperial students: It is vital though that students approach employers in a way that is both constructive and professional when attending a careers event: and 'It is imperative that you have questions ready when networking so that it is obvious to the employer that you're interested' (Steph Ahrens, Graduate Recruitment at Morgan Stanley). Joining professional bodies can also help you to meet industry professionals.

So, think about the information and insights you're hoping to gain, as well as the impression you want create. Plan your questions in advance and make sure present yourself as professional, confident, engaged and positive.

It pays to prepare

It is a good idea to **check their careers web pages.** Getting basic information in advance means that when you do speak to the representatives you can have a more meaningful conversation and come away with the added detail to help you with any applications. **Background research** can also help you to decide which companies you really want to target. Developing a LinkedIn profile and looking at interest groups and professional publications can also help with your research.

Key tips

- Develop your LinkedIn profile and join appropriate group and professional organisations.
- Remember that first impressions count. So if you are serious about a company or are it pays to turn up at the fair looking smart and presentable.
- Think of some questions that you can ask the company representatives.
- Remember the company representatives are often recent graduates themselves so now is the ideal time to find out what their experience has been so far, what the training programme was like, what support were they give, what is it really like to do that role, work for that company etc.

For a guide on networking with employers, visit our Quick guide to Networking at:
www.imperial.ac.uk/careers

BIOENGINEERING CAREERS FAIR

Utilise Yasmina's top networking tips at the Bioengineering Careers Fair on **Tuesday 12th November**, 5-7pm

FOR MORE INFORMATION CONTACT
Robert Ferguson

Innovation and Knowledge Centre

by Richard Kitney

As you will probably have heard, we won the national competition to establish the national innovation and knowledge (IKC) centre for synthetic biology. The IKC award is for the industrial translation of synthetic biology research. The money available within the IKC for collaborative projects with industry currently stands at £28m. This is an important innovation and has very significant potential for the UK economy. Currently the IKC has seven major industrial partners: Shell, GSK, Agilent, Microsoft, Syngenta, Life Technologies and Proctor and Gamble – together with around 30 UK based SMEs. The IKC will be located at the new Imperial West Campus.

#FUTUREISHERE

Check out what happened when the science and design communities joined up to talk about collaboration opportunities at #ScienceMeetsDesign LIVE from London.

'Future is Here' canvas is still open for new entries.

Science Museum Lates November

Science Museum do a 'Lates' event on the last Wednesday of the month. A number of members of the Department are keen to go along to the next one on 27th November. If you want to join us then email Jenna or Robert to express your interest. Lates runs from 18:45 to 22.00.

FAST FACTS

6%

Engineering workforce in the UK is female.

46%

Increase in number of girls taking GCSE physics since 2010.

HAVE YOU GOT NEWS?

If you have news you would like to share with the rest of the Department then contact Jenna.

Jenna Stevens-Smith

Women in Engineering

by Jenna Stevens-Smith

Women in engineering and science is a topic I feel very strongly about. In fact I have been expressing my views on the topic in written articles since 2010. The catalyst in 2010 was a report from the UKRC titled *Monitoring the presence and representation of women in SET occupations in UK based online media.* The report found that women were a statisitcal minority in online texts and that they had a muted representation on websites such as Wikipedia. The blog I wrote on this topic sparked some interesting comments including "hopefully that 30% of researchers and 8% of professors that are female can inspire more women to pursue science careers."

In 2011 I attended an event to celebrate the centenary of international women's day. The panel was inspirational and included Professor Dame Sally Davies (Chief Medical Officer and Director General of Research and Development for the Department of Health and NHS); Professor Carol Robinson (Dr Lee Professor of Chemistry at Oxford University); Professor Uta Frith (Emeritus Professor of Cognitive Development at UCL); Professor Mary Collins (Director of MRC Centre for Medical Molecular Virology); Liliane Lijn (Artist in Residence at NASA) and chaired by Vivienne Parry (Broadcaster, Journalist and passionate Science Communicator)

The panel agreed that women bring different attributes to the table compared to men, most noticeably leadership style. Mary Collins described it as women nurturing their teams, enabling their teams to gel. Uta Frith added that women are very good at pulling two or more different ideas together and are not naturally confrontational. Liliane Lijn the only non-scientist on the panel described women as "naturally intuitive with scientists using this characteristic alongside their rational and logical approach to work and life." What was clear was that scientists by nature are curious, they open one door and then many more doors open and questions to ask, it's this curiosity of science that drives so many scientists.

But the real take home message for me was the inspiration and more specifically the drive. What drives these successful women to be as successful as they are? Uta Frith held her hands up to say that none of them would say their journey to where they are now was easy or without complications. But as the saying goes it's not what obstacles that are put in front of you, it's how you overcome them. These women have sailed through adversity and come out as inspirational role models for the next generation.

No one can deny that people and society are not aware of the issue any more, but still in 2013 only 6% of the engineering workforce in the UK is female. Thankfully Government is now taking an interest thanks to consistent campaigning from groups such as WISE and Science Grrl. In June 2013 the House of Commons Science & Technology Select Committee launched an inquiry into women in STEM careers. On 30th September 2013 the Department of Business, Innovation and Skills announced the £200million fund to encourage more women to study science and engineering subjects. These two initiatives are a good step forward and I hope that it will lead to the culture change and support that is needed, not just for women but for all in STEM careers.

Within the Department of Bioengineering we have a Women's network for PhD, postdoc and academic staff. If you are interested in attending please email Dr Jennifer Siggers.

CLASS OF 2013

The new kid on the block

by Anthony Bull

The societal drivers for major activities at the interface of engineering, medicine and biology are known to us all. These include rising fertility, rising life expectancy and thus huge increases in total population size. Within this growth are the hidden factors of an increase in the proportion, and absolute number, of older people. When combined with an obesity epidemic in the developed world, and a substantial increase in musculoskeletal problems due to inappropriate physical activity in some subsets of the population, there arise some significant medical issues. The major medical challenges facing society currently, and that are projected to increase exponentially, are chronic conditions (for example, diabetes), dementia (most commonly Alzheimer's), and musculoskeletal pain (for example, due to osteoarthritis). It is, therefore, clear that we need *to engineer devices, constructs and interventions for human health*. This is my definition of *Biomedical Engineering.*

We are also living in an age of tremendous change in the life sciences: the human genome has been sequenced, new experimental techniques are coming online with great regularity, and engineers are getting involved. The opportunities in the life sciences, when combined with engineering and design technologies, are huge. For example, the precision control of biological matter at the very small scale is likely to change the way we produce very many things, such as fuels, materials and drugs. The new field of synthetic biology allows us now to conceive of a day when we will design living organisms for specific tasks in a scaleable manner. Engineers therefore are engaging in *solving problems related to the life sciences and/or the application thereof.* This is a definition of *Biological Engineering.*

Once engineers start getting to grips with biology, physiology, and anatomy, then new ideas arise. For example, Dr Rodriguez y Baena from Mechanical Engineering has taken inspiration from a wood wasp to develop a surgical drill that does not use rotary motion or impaction. He has found a new technical solution for human application from this biological system that has developed an efficient engineering solution. Engineers, therefore, can *find ways in which the structures and functions of living organisms can be used as models for the design and engineering of materials and machines.* This definition of *Biomimetics or Biologically Inspired Design* is the third main pillar of the discipline of Bioengineering.

This new discipline of Bioengineering, which incorporates these three main areas, is thriving at Imperial College and has a strong pedigree going back fifty years. In the 1960s three research groupings formed: the Engineering in Medicine Laboratory in Electrical Engineering (1963), the Biomechanics Laboratory in Mechanical Engineering (1966), and the Physiological Flow Studies Unit based in Aeronautics (1966). Two of these merged in 1989 to form the Centre for Biological and Medical Systems that in 1999 was given Departmental status. In 2001 the Department was renamed the Department of Bioengineering– the newest Department at Imperial. As befits a Department at Imperial, we are taking a national leadership role in the discipline of bioengineering in both research and teaching and now have thriving MSc, MRes and PhD programmes at the postgraduate level and have the largest UK Biomedical Engineering undergraduate programme.

As the discipline is still embryonic in the UK, there are some significant challenges facing bioengineers. !e first is quite simply a lack of recognition. Some may argue that bioengineering is not yet a profession, yet if one looks at the some of the key features of a profession – education and training activity, accreditation of degrees, regulation and protection of professional titles, strong industry and research base, recognised history, and presence in league tables – then it is clear that bioengineering has 'arrived'.

The Department established the UK Bioengineering Society in 2008. This learned society has a few hundred members and is now working with appropriate engineering institutions to accredit undergraduate bioengineering degrees. We also play a leading role in the Royal of Academy of Engineering's only special interest group – reflecting the importance of the discipline – the RAEng Biomedical Engineering Panel. There are approximately 5000 chartered engineers in the UK who would call themselves biomedical engineers, bioengineers or medical engineers and the US Bureau of Labor Statistics ranks biomedical engineering as the most valuable degree, with the discipline projected to grow the fastest of any profession over the next five years. !e medical devices sector in the UK currently has a turnover of approximately £15billion and employs approximately 70,000 people, mostly in SMEs. Research league tables rank the UK as third in the discipline (source: SC Imago Country Rank), and the department at Imperial as top in the UK and fourth in the world (source: http://bit.ly/IE19BioRank).

It is in the context of this fantastic position that the Department at Imperial is now embarking on a new phase in its lifecycle by consolidating its research excellence and providing growth and leadership in new areas such as Cancer Engineering, Neurotechnology, and Synthetic Biology. !is will inevitably involve some growing pains as the limitations of space and being ahead of the curve in terms of national funding priorities will have to be addressed. We are confident of tackling these issues successfully not only from an Imperial perspective, but also for the discipline as a whole. Therefore, from its embryonic beginnings fifty years ago, the Department can foresee a strong and healthy future in which staff and students are addressing some of the major issues facing society. We all look forward to the next fifty years.

Imperial iGEM go global

by Richard Kitney

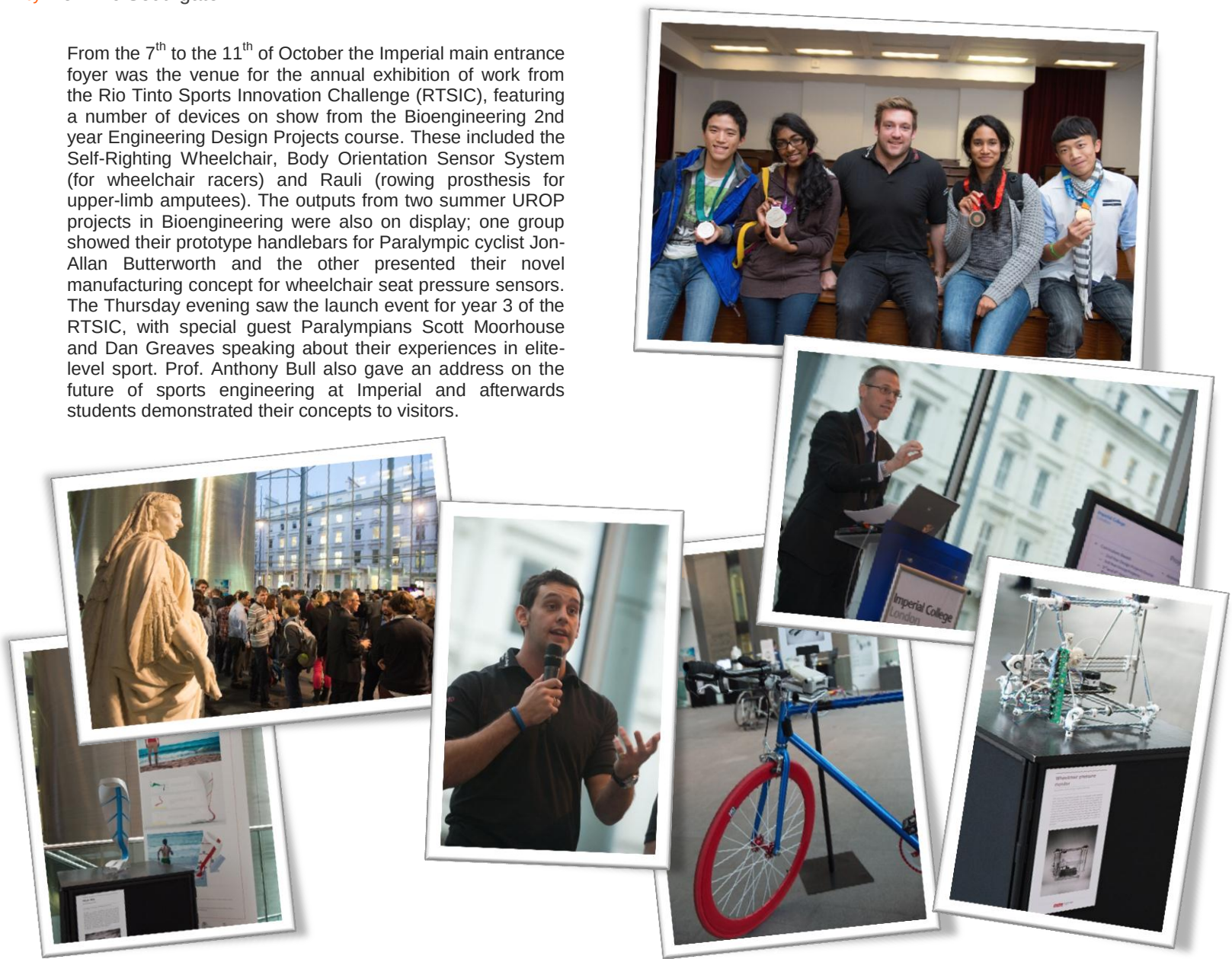
Our Imperial College team once again took part in the highly prestigious international student competition called iGEM (International genetically engineered machine competition). Approximately 200 teams from the world's leading universities take part in this competition annually and apply synthetic biology techniques to develop important new processes and devices. The Imperial College team has actually won of the most prizes in the competition over the last seven years. Because of the large number of teams involved, there are now regional finals and the European final took place in Lyon last weekend. As in previous years, Imperial College team did extremely well and are now one of the top teams who will be going to the world iGEM jamboree at MIT over the first weekend of November. Our team came 3rd out of 60.

The theme of this year's project has been the conversion of plastic waste (which would normally go into landfill) into bio plastic. They have developed sophisticated methodology, based on synthetic biology methods, to convert the plastic waste into new bio plastic which can be used in a wide range of applications and it is biodegradable. The students have actually made the bio plastic in significant quantities and have talked to technical as experts in the field of plastics who believe that the method is readily scalable to industrial quantities. Obviously, this has significant implications for landfill and the environment.

Rio Tinto Sports Innovation Challenge Year 3 Launch

by Dominic Southgate

From the 7th to the 11th of October the Imperial main entrance foyer was the venue for the annual exhibition of work from the Rio Tinto Sports Innovation Challenge (RTSIC), featuring a number of devices on show from the Bioengineering 2nd year Engineering Design Projects course. These included the Self-Righting Wheelchair, Body Orientation Sensor System (for wheelchair racers) and Rauli (rowing prosthesis for upper-limb amputees). The outputs from two summer UROP projects in Bioengineering were also on display; one group showed their prototype handlebars for Paralympic cyclist Jon-Allan Butterworth and the other presented their novel manufacturing concept for wheelchair seat pressure sensors. The Thursday evening saw the launch event for year 3 of the RTSIC, with special guest Paralympians Scott Moorhouse and Dan Greaves speaking about their experiences in elite-level sport. Prof. Anthony Bull also gave an address on the future of sports engineering at Imperial and afterwards students demonstrated their concepts to visitors.



CBIS Update

by Melissa Sullivan

The 17th October was a momentous day for CBIS, marking both the official opening of the Centre by HRH Prince Harry and also being the day of CBIS second networking event.

Prince Harry was introduced to the Centre by a guided tour of our laboratories. HRH almost managed to blend in with our CBIS researchers apart from the embroidered 'HRH' across the back of his white personalised lab coat.

Dr Theofano Eftaxiopoulou and Dr James Wilgeroth demonstrated the shock tube to HRH and explained how scientists put materials in the way of the shockwave to analyse its effects and thus allow better protective gear to be developed. Prince Harry also met with Professor Sara Rankin, theme leader for biology and therapeutics and Dr William Proud, theme lead of blast force protection who presented the split Hopkinson bar device to HRH, which simulates how shockwaves from IEDs damage people at the cellular level. Following a blast impact, victims can experience extremely painful side effects such as bone forming inside muscle tissue, a process which is still poorly understood and being researched intensively by CBIS. HRH was also shown the Anti-vehicle, Underbelly, Blast-Injury Simulator (AnUBIS) which allows researchers to investigate how roadside bomb blasts impact on the lower limbs, which could lead to better protective gear being developed in the future.

Before unveiling a plaque to commemorate CBIS's official opening, HRH gave a speech addressing how important the research is at the centre:

"Today, I have had a brief insight into the work of the Centre including how injured cells are analysed. In the past I've met numerous service men and women injured in operations, many by IEDs and landmines. Their stories are harrowing and inspirational as I am sure you all know. Watching the IED simulation reminded me of the catastrophic trauma experienced by the human body during IED or mine-strikes. To me this makes their extraordinary stories of recovery all the more outstanding. This issue affects people on a global scale and whilst work at the Centre is strongly focussed on military casualties, its findings will no doubt also provide significant humanitarian benefits across the world. The Royal British Legion and Imperial have joined forces to tackle this issue head on. Without this partnership the Centre would quite simply not become a reality."

The CBIS networking event ran in parallel with the official opening and included an array of exciting lectures about blast injuries and different aspects of the research taking place at the centre. Professor Anthony Bull opened the event with an introductory talk discussing the aims and intents of the centre followed by a splendid morning of presentations from speakers including Professor Sir Simon Wessely, Dr Mazdak Ghajari and Major James Singleton. The talks ranged from myths of military mental health and traumatic brain injury to battlefield injury clinical research currently occurring at CBIS.

The second half of the event included lectures given by Surgeon Captain Mark Midwinter CBE, Wing Commander Alex Bennett, Dr Tobias Reichenbach and Dr Spyros Masouros on a multitude of intriguing topics including rehabilitation research, blast induced hearing damage and measuring injury burden and outcome parameters in combat trauma.

The Network meeting poster competition was of extremely high standard with First prize being awarded to Scott Armstrong and highly commended awards being given to CBIS's own Ashton Barnett-Vanes and Nic Newell. Congratulations to all on your excellent submissions.

October was an eventful month for CBIS and we look forward to more excitement to come, with our CBIS Day fast approaching bringing together our PhD students and PDRA's once again with an opportunity to provide research updates. The CBIS Sporting Challenge also awaits at the Go-Kart track!

Lastly a fond farewell to Major James Singleton, who has now completed his MD within the Centre and has returned to his duties as a full time orthopaedic surgeon. We wish him all the best with his future endeavours; he will be greatly missed by all.

THE PRINCE IN PICTURES

HRH Prince Harry arrives at Imperial and is given a tour of the Royal British Legion Centre for Blast Injury Studies by Professor Anthony Bull.

On arrival HRH Prince Harry is introduced to members of the CBIS, advisory board, Faculty of Engineering and TRBL.

After speaking and unveiling the plaque HRH Prince Harry was introduced by Professor Anthony Bull to other VIPs including Sir Bobby Charlton.

The event was incredibly well attended with a number of attendees keen to get a sneaky photo of Prince Harry as he met guests.

Making an impact

by Jenna Stevens-Smith

"Every organisation that funds research wants to support research that makes a difference." So began the Impact-themed issue of Nature on 17 October 2013. Sadly there is no simple recipe for identifying which research will make an impact.

Assessing the quality of research has played an integral role in the allocation of funding to UK universities since the first research assessment exercise in 1986. Evaluating quality of research has been a continual challenge as evaluation systems have had to rapidly evolve to keep up with the changes in the way that science and engineering is practiced and communicated.

The first research assessment came about in 1986 during Margaret Thatcher's conservative government at a time of tight budgetary restrictions. The research funding was allocated to Universities depending on the quality of the research. As the economy settled down Government still saw benefits in research assessment as the mechanism for allocation of funds and subsequent research assessment exercises were undertaken in 1989, 1992, 1996, 2001 and 2008. The name of these assessments has changed over the years and the ways that they measure 'quality' have also evolved but their purpose has consistently remained to allocate funding to UK Universities.

"£1.6 billion a year in block grants to universities."

Why is it important?

The purpose of REF (Research Excellence Framework) 2014 is to allocate funding. Last year the UK Government used the assessment to distribute more than £1.6 billion a year in block grants to universities. It is important to score well in REF as last year more than 70% of the £1.6 billion of funding went to the top-scoring 20 or so universities. A significant change to REF this time around was the inclusion of economic and social impact of university research. Although these national assessments can sometimes be viewed as a "bureaucratic imposition which stifles creativity" the inclusion of impact encourages researchers to consider where their research fits in the bigger picture. More and more funding bodies are including 'impact statements' in their funding applications so the process of considering and developing these impact case studies will have longer term benefit.

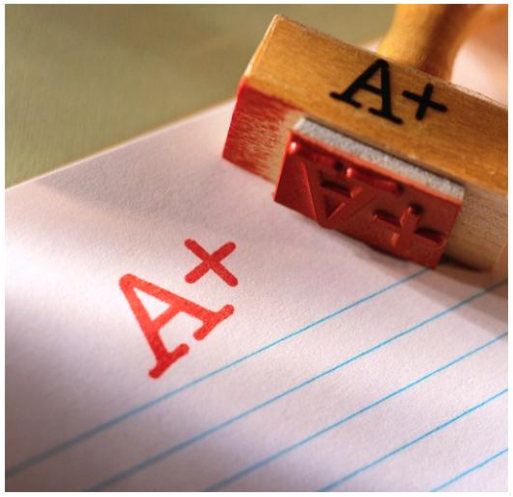
How can you embed impact in your research?

To measure impact we have to be able to explain who might benefit from the research and how they would benefit. In bioengineering we are well placed to be able explain this more easily than other disciplines. We also have to be able to show the process of delivering impact, so-called 'pathway to impact' in REF.

Research Councils UK (RCUK) don't just want to hear about how your research is delivering impact they want to fund it, with ~5% of the grant budgets going towards impact activities. This could include a range of activities from paying for a research associate to work in an industry lab, visiting schools, developing educational materials, communicating science to the public, training young scientists or collaborating with industry. RCUK are not the funding body that are putting money behind impact. The Wellcome Trust, a leading biomedical research funding charity has recently launched a new funding scheme for researchers funded by the Wellcome Trust to apply to for provision of public engagement funding in addition to your research grant.

You can listen to Professor Jeremy Farrar, Director of the Wellcome Trust, talk about why he thinks it is important to connect your research with society here.

AROUND DEPARTMENT



Accreditation

Well done to Liam Madden and all team that worked together for the Accreditation of the BEng, MEng and MSc courses which culminated in an Engineering Accreditation Board visit held on 30-31st October. We will know the formal outcome in the next few weeks. Special thanks to the student representatives, alumni and industry representatives that spoke to the Engineering Accreditation Board on Wednesday 30th October, your involvement was very much appreciated.

Christmas Party

It is that time of year again (nearly) and the Department Christmas Party for PhD students and staff will be on **Monday 16th December**. Further details will be emailed around closer to the time, but for now save the date!

New Algorithm Can Spot the Bots in Your Twitter Feed

By Lee Simmons (featured in WIRED on 17th October)

You know Twitter spam when you see it—but wouldn't it be nice if you didn't *have* to see it?

Unfortunately, email-style filters, which analyze message contents, are of little help. Due to the rigors of 140-character communication, even legitimate tweets tend to read like Nigerian phishing scams, while the hucksters often hide their pitches in links. So Twitter simply puts the onus on users to report offending accounts.

But a fascinating recent study from Imperial College London suggests a new approach. Borrowing some tricks from computational neuroscience, coauthors Gabriela Tavares and Aldo Faisal have come up with an algorithm that can tell—with 85 percent accuracy—whether a Twitter account is home to a bot or (worse) a corporate shill instead of a regular person.

It's all in the timing. By analyzing the timestamps on 165,000 tweets, the researchers found that these three user types—individuals, companies, and robots—have very distinct activity patterns. Think of it as temporal fingerprinting. The approach could eventually be used to create more effective filters for all kinds of social networks.

Looking at just the relative frequency of tweets sent over the course of the day, characteristic patterns emerge for each account class. But the new algorithm also parses user activity on a much deeper level. Could a spammer simply program their bots to mimic human behaviour? "It would be very hard," says Tavares, now at Caltech. "This isn't a deterministic model—it's not a matter of just tweeting at certain times of day or certain intervals. The classifier uses machine learning to build probability distributions; without knowing the parameters of the model, you couldn't simulate the expected behaviour."

Stopping spam is a cause everyone can get behind. But as Faisal, a lecturer in neurotechnology at Imperial College, points out, the results also tell a bigger story about the informational richness of communications metadata—the seemingly trivial details of our connected lives. "It illustrates how even the most basic metadata can reveal a great deal about who you are," he says. Something to think about, perhaps, in light of revelations that the NSA is busily skimming just such data from our telephone calls.

In fact, the new algorithm can not only tell whether you're a good Twitter citizen or a spammer, it can even predict the timing of your next tweet with surprising accuracy—provided you're human, that is. Turns out that people, as a group, are more predictable than robots. So much for our vaunted human spontaneity. Those annoying tweets that arrive with machinelike regularity each day? Those are actually your friends.

Bioengineering Newsletter

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