Bioengineering news

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THE LEADING DEPARTMENT OF BIOENGINEERING IN THE UK

IN THIS ISSUE

Head of Department's message

by Professor Anthony Bull

Bioengineering – A family affair

There are milestones in a young department's life that reflect its growth, maturity, stability, and success as measured by many different factors. Many of these aspects are to do with people and how their involvement in the Department is linked with key points in their life.

For example, one of these is being able to celebrate our first PhD graduate who came to us directly from school, via our undergraduate degree. We achieved this a couple of years ago when Dr Sevil Payvandi was awarded her doctorate under the supervision of Dr Jennifer Siggers.

Another important milestone is the appointment of one of our own PhD graduates to an academic position in the Department. There have been a few of these, including Professor Peter Weinberg and Dr Danny O'Hare; most recently, Dr Spyros Masouros joined the department as a lecturer having also completed his PhD here.

One of the most gratifying milestones is the celebration of the first wedding from our undergraduate cohort. We heartily congratulate Roshini and Akshay who have demonstrated that Bioengineering is not only about studies, but also leaves time and space for the finer things in life.

"What do we have to look forward to next?" you may ask. Well, we've already had siblings graduate from the course, so perhaps we can look forward to one of our own children joining the department in the future.

With this in mind, I would like to congratulate Ozan on the birth of his daughter and Chiu Fan on the birth of his son. Are they laying the groundwork for our 2031 intake?

Strictly science

The work of the Department's Neurotechnology group featured in the MRC's centenary Strictly Science exhibit at Imperial recently.

Page 02

A date with discovery

If you've ever wondered what life's like on the surface of Mars, why babies kick in the womb or how your brain understands and reacts to music, the wait is over. Imperial Festival is back.

Page 03

A free interactive exhibition at Imperial College London celebrates a century of progress led by the Medical Research Council

by Kerry Noble

Running from 04 to 14 April at Imperial's Main Entrance on Exhibition Road, Strictly Science contrasted scientific endeavors in 1913 with those today, and attracted over 4,000 visitors to speculate on the next 100 years.

The MRC, a national organisation funded by the UK taxpayer and dedicated to improving human health, has origins that can be traced back to 1911, when Parliament passed the National Insurance Act, introduced to help helped tackle an epidemic of tuberculosis.

Strictly Science featured a series of interactive installations across three main zones where members of the public, young and old, explored past and current achievements of the MRC and speculate on the future of medical science.

A century-old laboratory installation re-enacted experiments on the nervous system, war-wound treatment and vitamin-deficiency disease.

A contemporary neurotechnology lab, based on the work of the Department's Faisal group, invited visitors to play with interactive experimental tools – Wii balance boards, eye-trackers, and a motion capture suit – these are all things that are used by Dr Aldo Faisal and his team to investigate how the human brain works. He said:

PhD student Will Abbott (second from left) explains how to play the interactive computer game to visitors

"Our work focuses on the rapidly growing area of neurotechnology, which is a field of science that fuses technology and neuroscience. Ultimately, we want to understand how the brain works when it is healthy, so that we can develop technological solutions to help patients with neurological disorders to function more effectively in their day-to-day lives. This exhibition gives us the opportunity to talk to visitors about the work that my colleagues and I do and lets the public experience our neurotechnology hand's on. It also gives us an opportunity to celebrate the fantastic work that the MRC does, reflect on its history and imagine about future of things to come."

The work of Dr Aldo Faisal and his group featured in the 'Today' section of the exhibit and will be available to view at the Imperial Festival,03-04 May 2013

Aldo was on an MRC podium panel discussion as part of the event. The panel discussed the future of medical research and the importance of biomedical engineering as an integral part of medical research.

A sound installation explored our hopes and fears for the next century. Featuring opinions from Melvyn Bragg, Susan Greenfield, Jon Snow, Robert Winston and many more, alongside those of UK primary school children, the exhibit asked "What will the world be like in 2113?" Future booths invited visitors to share their views and contribute to a growing archive of future perspectives.

Brona McVittie, Strictly Science Exhibition Manager said: "Strictly Science not only celebrates 100 years of progress in medical research, but accentuates how knowledge gained through basic research shapes our life in general, from culture and commerce to politics."

Aldo co-directed this exhibition and with his team developed the 'Today' lab which will also be part of the Imperial Festival 03-04 May 2013.

READ ALL ABOUT IT

Got an item for the next newsletter?

EMAIL
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GRANT AND CONFERENCE NEWS

Synthetic yeast genome

Dr Tom Ellis has recently been awarded a four-year £1.25 million BBSRC grant to construct a synthetic version of a brewer's yeast chromosome as part of a global project to build a synthetic version of yeast genome. This is the first genome synthesis project of a eukaryotic genome and currently the largest synthetic biology project in the world. The UK part of this project will be led by Imperial's Centre for Synthetic Biology and Innovation and includes groups at Edinburgh and Cambridge Universities. As well as the UK group, the global consortium also includes teams from the USA, China and India, all of whom will be coming to Imperial this July for the annual consortium meeting.

BHF grant

Professor Peter Weinberg and **Dr Zahra Mohri** have been awarded a three-year British Heart Foundation Project grant entitled 'Test of a new 'comfort zone' theory relating mechanical stresses to atherosclerosis'

EU-FP7 grant

Dr Etienne Burdet has received a grant from the EU-FP7 which will enable them to tackle the problem of stability in neurologically impaired subjects, and develop assistive exoskeleton strategies.

Plenary lectures and talks

Dr. E.M.Drakakis will deliver a plenary lecture on 'Harnessing the MOS transistor non-linearity: From bionic ears to cytomimetic circuits' at the international conference 'From Medicine to Bionics' to be held in Budapest, 13-15 June 2013.

Dr A.A. Faisal will deliver the keynote lecture on 'Towards behavioural neurotechnology: From task-level brain-machine-interfaces to human ethomics" at Neurotechnix , Portugal, 18-20 September 2013.

Drs Kit Longden, Holger Krapp and **Carsten Mehring** gave invited talks at the BNA conference this month.

Dr Etienne Burdet gave an invited lecture on 'Human Robotics' at the South China University of Technology in Guangzhou, China, on 09 April.

NEWS IN BRIEF

Many congratulations to **Dr Angela Kedgley** who has been awarded an Imperial College London Junior Research Fellowship.

Dr Simon Schultz has been in Nottingham during April running a Marie Curie training workshop for our EU training grant NETT: Neural Engineering Transformative Technologies.

Congratulations to **Ozan Cakir** and his wife on the recent arrival of their beautiful baby daughter. Congratulations too to **Dr Chiu Fan Lee** and his wife on the arrival of their son Felix.

Baby bump body suit engineer explains womb movements at Imperial Festival

by Michael Jones

Why do babies kick in the womb?

Expectant mothers, prospective fathers and all the family can find out more about why and how a baby moves around in the womb at the Imperial Festival.

Find out at the Festival!

One of the major exhibits in the Research Zone marquee at the Festival on Friday 03 May and Saturday 04 May will be an extraordinary body suit, which allows wearers to feel what it's like to be eight months pregnant. **Dr Niamh Nowlan** and project collaborator Dr Ravi Vaidyanathan have also developed a sensor which picks up different movements that can be used to improve understanding of pregnancy.
Dr Nowlan, from the Department of Bioengineering, said: "Understanding why babies kick is an important aspect of our research. The baby bump bodywear is an excellent way to demonstrate some of the things we look at in our studies and helps people understand what it's like to be at a late stage of pregnancy. The new sensor picks up all sorts of signals from around the belly, so could have a range of applications beyond pregnancy too."
Monitoring how babies move around and kick is important, but also knowing why they move and what it means when they don't kick can be vital to track potential health implications. As part of the exhibit, Dr Nowlan, and her team will explain the variety of actions and how they can be interpreted.

Bioengineering gets involved

Alongside Dr Nowlan's research, many other world-leading experts will demonstrate their research or give talks on their fields of science, medicine, business and engineering at the second annual Imperial Festival and there'll be lots of involvement from elsewhere in the Department including:

- **Saturday 04 May, 15.00 SAF G16 -** Brains behaving badly. **Dr Aldo Faisal** talks about his work in understanding how brains behave badly and what can be done to fix them.
- **Research zone** – Paralympic sports equipment. Try out prototypes for improving sport and lifestyles for people with disabilities, developed by students in the Rio Tinto Sports Innovation Challenge.
- **Research zone** – The Blast Lab. Use a toy air gun to discover the effect of blasts on real soldiers, and explore research into reducing the number and extent of injuries to serving military personnel.
- **Research zone –** Neurotechnology lab. Have a go at playing Pong with a brain machine interface and other interactives courtesy of the Faisal Lab.
- **Soapbox science** – **Dr Martina Wicklein** will take to her soapbox to answer visitors' questions and respond to their heckling!

In addition, interactive displays from researchers, acts from comedians, actors and science buskers, as well as musical performances and artistic collaborations will contribute to the Festival, which welcomed over 7,000 adult and family audiences last year.
Free and open to all, the second annual Imperial Festival takes place at the College's South Kensington Campus on Friday 03 and Saturday 04 May. Members of the public can drop in at any time during the Festival. Come along!

Outreach and public engagement

Pint of Science

Dr Simon Schultz, Dr Tom Ellis and **Dr Dominic Southgate** are speaking at Pint of Science on 14, 15 and 16 May respectively. All three will be taking the floor at the Price Edward pub in Bayswater (W2 4NY). Simon will be speaking about his research into optical neurotechnology, Tom on the benefits synthetic biology can bring to beer production and Dominic on using motion capture to analyse the function of the human body. Further information and free tickets can be found by visiting the pint of science website.

Big Bang

Drs Rob Dickinson and **Rishi Goburdhun** attended the Big Bang Fair in London's ExCeL last month to show case Imperial's pop up surgery which explained to visitors what happens when someone has a heart attack. Rob and Rishi's work involves the development and use of a new patient information system tailored to a clinical pathway.

Friends of Imperial lecture

Dr Aldo Faisal recently delivered a lecture on 'Breaking into your Brain'. Applying computing, physics and engineering methodology to experiments with our brains to understand how they work from first principles has led to the invention of a number of low cost machines. The lecture was given to 400 donors from the Friends of Imperial Society.

Osteobio visit

The Department welcomed a group of osteopathy students from Osteobio in Paris for a tour of the laboratories and facilities recently. Paul Kraaijeveld, one of the Osteobio lecturers said "We would like to thank you for the guided visit. We all thoroughly enjoyed the tour, it was very well-organised with great student ambassadors. The demonstrations and explanations in the labs were particularly interesting for our students. I hope to send some of our students to Imperial in the near future." Many thanks to **Laura McKay, Edit Toth, Reva Vaze, Dr Mariea Brady, Amanda Wilson, Dr Niamh Nowlan** and **Mario Giorgi** for all their help during the visit.

A bioengineering romance

by Roshini Chaudhri (MEng Biomedical Engineering, 2008)

In my final year at school, a teacher was giving a lecture about university. He mentioned that it would be the place where a majority of us would meet our life partners. I remember thinking, "Really? I doubt that". Bear in mind most of the adults I knew at that point met through arranged marriages…

I remember meeting Akshay on the first day of university, we said "Hi", and probably had a typical 'first day of university' chat. We were in different halls and had different friendship groups, so we never really hung out (surprising for a class of 60). My closest course mates were on the BEng course and so in the third year, when Akshay and I were on the Mechanical Engineering stream of the MEng course, we finally got to know each other. We complained about classes, shared notes and had a competition on who could get a job first (I won). Our journey started in the final year of university, with low expectations of lasting after university. However, we made it to five years, by which time we were engaged to be married on 30 December 2012. We are in month four of being married, year six of dating, year seven of being friends and year nine of being familiar with each other. I guess my high school teacher was right after all!

The Department sends many congratulations to Roshini and Akshay on their recent marriage.

We also send our best wishes to Niti and Avnish, who are another Bioengineering couple due to get married in Kenya later this year…we eagerly await the photographs!

Mr and Mrs Chaudhri on their wedding day. They met as undergraduates on their very first day in the Department.

Publications

Departmental publications are reported in the newsletter every quarter. This information is drawn from Symplectic, information on which can be found here.

Journal articles

Allievi,A.G., Melendez-Calderon,A., Arichi,T., Edwards,A.D., and Burdet,E. (2013) An fMRI Compatible Wrist Robotic Interface to Study Brain Development in Neonates. *Ann Biomed Eng*.

Bonfiglio,A., Repetto,R., Siggers,J.H., and Stocchino,A. (2013) Investigation of the motion of a viscous fluid in the vitreous cavity induced by eye rotations and implications for drug delivery. *Phys Med Biol* **58**: 1969-1982.

Caze,R.D., Humphries,M., and Gutkin,B. (2013) Passive dendrites enable single neurons to compute linearly non-separable functions. *PLoS Comput Biol* **9**: e1002867.

Dominguez-Huttinger,E., Ono,M., Barahona,M., and Tanaka,R.J. (2013) Risk factor-dependent dynamics of atopic dermatitis: modelling multi-scale regulation of epithelium homeostasis. *Interface Focus* **3**.

Galligan,J.J., Patel,B.A., Schneider,S.P., Wang,H., Zhao,H., Novotny,M. *et al.* (2013) Visceral hypersensitivity in female but not in male serotonin transporter knockout rats. *Neurogastroenterol Motil*.

Ganesh,G., and Burdet,E. (2013) Motor planning explains human behaviour in tasks with multiple solutions. *Robotics and Autonomous Systems* **61**: 362-368.

Harrison,M., Smith,E., Ross,E., Krams,R., Segers,D., Buckley,C.D. *et al.* (2013) The role of platelet-endothelial cell adhesion molecule-1 in atheroma formation varies depending on the site-specific hemodynamic environment. *Arterioscler Thromb Vasc Biol* **33**: 694-701.

Papadimitriou,K.I., Stan,G.B., and Drakakis,E.M. (2013) Systematic computation of nonlinear cellular and molecular dynamics with low-power CytoMimetic circuits: a simulation study. *PLoS One* **8**: e53591.

Patel,B.A., Luk,C.C., Leow,P.L., Lee,A.J., Zaidi,W., and Syed,N.I. (2013) A planar microelectrode array for simultaneous detection of electrically evoked dopamine release from distinct locations of a single isolated neuron. *Analyst* **138**: 2833-2839.

Peiffer,V., Bharath,A.A., Sherwin,S.J., and Weinberg,P.D. (2013) A novel method for quantifying spatial correlations between patterns of atherosclerosis and hemodynamic factors. *J Biomech Eng* **135**: 021023.

Peiffer,V., Sherwin,S.J., and Weinberg,P.D. (2013) Does low and oscillatory wall shear stress correlate spatially with early atherosclerosis? A systematic review. *Cardiovasc Res*.

Ramasamy,A., Hill,A.M., Masouros,S., Gibb,I., Phillip,R., Bull,A.M., and Clasper,J.C. (2013) Outcomes of IED foot and ankle blast injuries. *J Bone Joint Surg Am* **95**: e25.

Rogers,M.L., Brennan,P.A., Leong,C.L., Gowers,S.A., Aldridge,T., Mellor,T.K., and Boutelle,M.G. (2013) Online rapid sampling microdialysis (rsMD) using enzyme-based electroanalysis for dynamic detection of ischaemia during free flap reconstructive surgery. *Anal Bioanal Chem* **405**: 3881-3888.

Rogers,M.L., Feuerstein,D., Leong,C.L., Takagaki,M., Niu,X., Graf,R., and Boutelle,M.G. (2013) Continuous online microdialysis using microfluidic sensors: dynamic neuro-metabolic changes during spreading depolarisation. *ACS Chem Neurosci*.

Sen,S., Asrress,K.N., Nijjer,S., Petraco,R., Malik,I.S., Foale,R.A. *et al.* (2013) Diagnostic Classification of the Instantaneous Wave-Free Ratio Is Equivalent to Fractional Flow Reserve and Is Not Improved With Adenosine Administration: Results of CLARIFY (Classification Accuracy of Pressure-Only Ratios Against Indices Using Flow Study). *J Am Coll Cardiol* **61**: 1409-1420.

Sootla,A., Strelkowa,N., Ernst,E., and Barahona,M.S.G.B (2013). Toggling a Genetic Switch Using Reinforcement Learning. *Computer Science: Systems and Controls*.

Tanaka,R.J., and Ono,M. (2013) Skin Disease Modeling from a Mathematical Perspective. *J Invest Dermatol*.

Wright,O., Stan,G.B., and Ellis,T. (2013) Building-in Biosafety for Synthetic Biology. *Microbiology*.

Conference proceedings

Tang, M.X. Beam Hardening in Ultrasound Contrast Agent Imaging

Vicente,A. and Faisal,A.A. (2013). Calibration of kinematic body sensor networks : Kinect-based gauging of data gloves 'in the wild', IEEE 10th Intl. Conference on Body Sensor Networks, Cambridge (MA)

Neishabhouri,A., and Faisal,A.A. (2013). Energy constraints link structure and function in thin axons in the brain's wiring. COSYNE, Salt Lake City (UT)

Ticchi,A. and Faisal,A.A. (2013). A biophysical model of Bayesian inference and MCMC sampling in neural circuits. COSYNE, Salt Lake City (UT)

Abramova,E., Dickens,L., Kuhn,D. and Faisal,A.A.(2013) A model of hierarchical motor control and learning: from action sequence to muscular control. COSYNE, Salt Lake City (UT)

Publication news

A recent paper resulting from a collaboration between the 'Bioinspired VLSI CAS' group – Circuits for and from Biology and the 'Control Engineering Synthetic Biology' group entitled "Systematic Computation of Nonlinear Cellular and Molecular Dynamics with Low-Power CytoMimetic Circuits: A Simulation Study" authored by K.I.Papadimitriou, G-B.Stan and E.M.Drakakis has been judged by the Target Selection Team of the Global Medical Discovery Series to be of special interest to the drug development sector. The paper has been selected for inclusion in the next edition of the Global Medical Discovery Series which alerts the scientific community to breaking journal articles considered to be of importance to the drug discovery process and is viewed almost 365,000 times each month by an extended audience of academic and industrial R&D personnel. Global Medical Discovery is featured on the intranets of the top 40 BioPharmaceutical companies and major academic institutions.

Student success

Congratulations to two students from **Aldo Faisal's** lab: third year PhD student **Ekaterina Abramova** was awarded the US$ 250 Qualcomm Award for her submission 'Model of hierarchuical motor control and learning: From action sequence to muscular control' (Abramova, Dickens, Kuhn and Faisal) at COSYNE 2013 and second year PhD student **Feryal Mehraban Pour Behbahani** for winning the Google Poster Award for her submission 'Human category learning is consistent with Bayesian generative but not discriminative classification' (Pour Behbahani and Faisal).

Events

Departmental Seminars

All seminars will be on Thursday 13:00-14:00 in room RSM 3.03 unless otherwise stated. A full list of seminars can be found on the events page.

For further details please contact Chiu Fan Lee. If you know of someone who would like to be on the email distribution list for these seminars please guide them to sign up list.

02 May 2013
Professor Nancy Allbritton, University of North Carolina. Microengineered devices for advancing preclinical and clinical research.

09 May 2013
Prof Raul Perez-Jimenez. Nanoscience Cooperative Research Centre. Title TBC.

13 May 2013
Professor Alexander Rachev. Institute of Mechanics, Bulgarian Academy of Science, Sofia. Growth and remodelling of natural and tissue engineered arteries.

15 May 2013. 11:00-12:00
Professor David N. Ku, Lawrence P. Huang Endowed Chair in Engineering and Entrepreneurship and Regents' Professor, Georgia Tech. Title TBC.

16 May 2013
Professor Nicolas Schweighofer. University of Southern California. Title TBC

22 May 2013. 10:00-11:00
Prof Francisco Valero-Cuevas. University of Southern California. Title TBC.

23 May 2013
Professor Martin Fussenegger. ETH Zurich. Title TBC.

06 June 2013
Dr Nathan Goehring. Cancer Research UK. Title TBC.

Inaugural lecture

28 May 2013. 17:30-18:30
1.31 Royal School of Mines
Professor Martyn Boutelle.
The doctor will sense you now. Professor Boutelle explores the advancement of biomedical sensors for clinical monitoring in his inaugural lecture. Please register in advance by emailing Kathleen Weeks.

Imperial Festival

03-04 May 2013
From dancing to robots, brains to buskers, spark something different at the second annual Imperial Festival

Bioengineering news

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