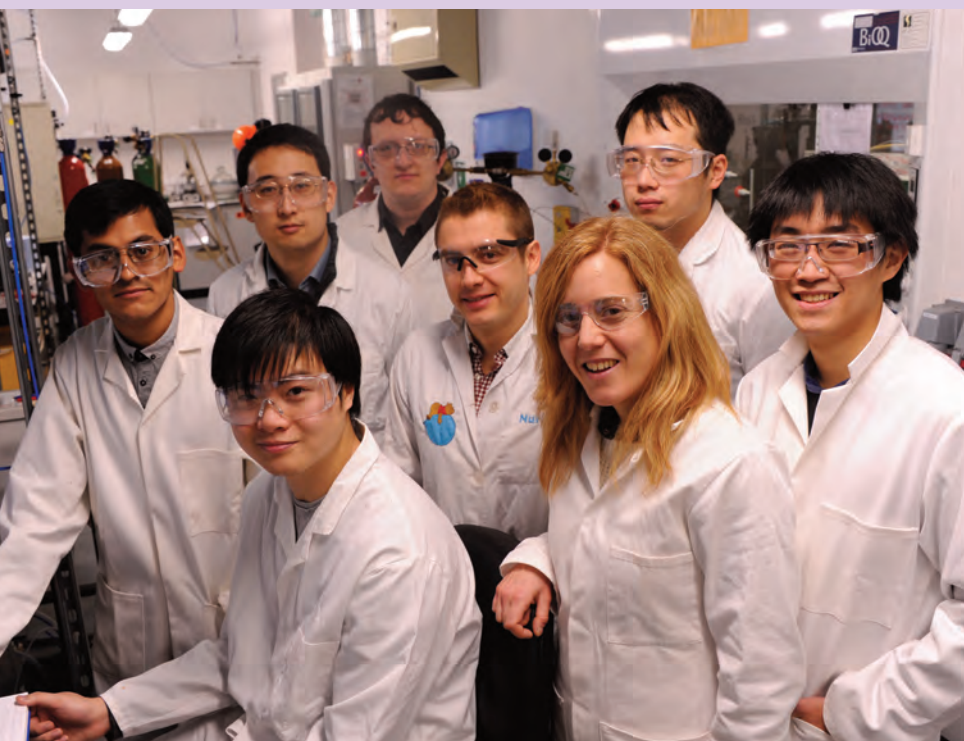


CEB *Focus*

Department of Chemical Engineering and Biotechnology



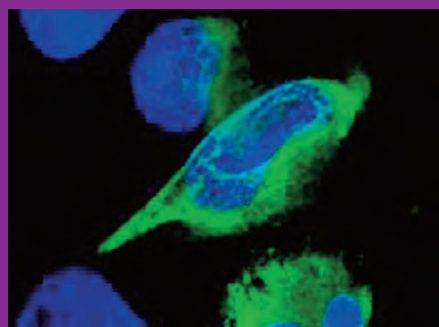
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Message from HoD Professor Nigel Slater



This is my final 'message of welcome' in *CEB Focus* as by the next edition in October the leadership of the department will have passed to Professor John Dennis. My final months will though be extremely

busy since by October we shall have relocated all our activities to the new building at West Cambridge and will be making final preparations to greet the first cohorts of CEB undergraduates, graduate and research students that will be educated exclusively at that site. The facilities will be tremendous and the move represents a unique opportunity for the Department to have a completely new start at a new site with new leadership. I wish John and the Department every success in that exciting endeavour.



CEB Editorial Team from right to left: Elena Gonzalez (Chief Editor) with volunteers Fanny Yuen, Kaichen Gu, Hannah Templeton, Geertje van Rees, Noha Al-Otaibi and Azraa Pankan

Editorial Note

The *CEB Focus* Editorial Team wishes you all a fantastic summer. *CEB Focus* Newsletter is the product of a joint team effort led by Elena Gonzalez (Chief Secretary and Chief Editor). The Editorial Team is fully committed to the project contributing their enthusiastic ideas to help further develop the publication look and editorial content. We are always open to recruit new keen volunteers so please email us on ceb-focus@ceb.cam.ac.uk if you are interested in joining us.

The *Front Cover Article* focuses on CEB's support of the EU H2020 Research and Innovation initiative awarding funding for talented researchers to develop their research and career.

The recently launched column, *CEB Women in Chemical Engineering and Biotechnology*, features an inspirational personal profile by Dr Claire Michel, a Postdoc in the Laser Analytics Group researching the live cell and organism imaging of amyloid species and their interaction. In *Industry Business* Dr Graham Dransfield, CEB Knowledge Transfer Facilitator, reports on the latest exciting collaborations with industry partners including Woolcool and Invista, the latter being the latest company addition to the CEB Teaching Consortium of Companies portfolio.

Undergraduate Focus features the new CUCES Chemical Engineering Society Committee led by President Rachel Oldham as well as a report on Frank Morton Games, CUCES Annual Dinner and the IChemE Undergraduate Project Prize, whilst *Graduate Hub* tells about CEB success at the CUE entrepreneurship competition and I-Teams Project. *Teaching Matters* focuses on the Pilkington Teaching Award to Dr Bart Hallmark.

Research Highlights includes research breakthrough by CEB Postdoc Dr Alastair Crisp in the Cell and Organism Engineering group, whose ground-breaking study claims that humans may have evolved with genes from plants. The *Research Feature* is a contribution by Dr David Fairen-Jimenez, leading the Adsorption and Advanced Materials Group, on Metal Organic Frameworks (MOFs).

Alumni Corner shares recollections from a time in Cambridge by Chemical Engineering alumnus Miles Kennedy (1954 graduate) as well as the astounding achievement from bio alumnus Dr Darrin Disley, recently named 'Entrepreneur of the Year' and 'Executive of the Year' in the Quoted Company Awards 2015. CEB is also sad to inform of the recent passing of former Biotechnology Faculty member Dr Geraldine Rodgers.

People Focus presents leaving HoD, Professor Nigel Slater, with his 'memoirs' of his time in post and *Staff Room* reports on the latest progress made in the new building site in West Cambridge and the launch of the CEB Staff Survey. Finally, *CEB Focus* would like to thank webmaster Vanessa Blake for regularly providing photos and department members, alumni and corporate partners for article contributions. Please keep sending them to ceb-focus@ceb.cam.ac.uk. To receive a regular e-copy of CEB Focus subscribe by sending a message to ceb-news-request@lists.cam.ac.uk with 'Subscribe' as the subject of the message. Remember current and previous newsletter issues can be downloaded from www.ceb.cam.ac.uk/news/ceb-focus or viewed from any mobile device on www.issuu.com/cebcambridge

H2020 Marie Curie Fellowships: Developing the Researchers of the Future

Elena Gonzalez



Back in November 2013 the European Parliament in Brussels approved and adopted the Horizon 2020 budget for research and innovation, the biggest EU Research and Innovation Framework programme ever, with €79 billion of funding available until 2020. Under the H2020 Marie Skłodowska-Curie Actions (MSCA) fellowship programme, CEB is hoping to attract more talented researchers.



CEB young researcher looking for solutions to global problems

MSCA fellowships have been allocated more funding under the EU Horizon 2020 with MSCA accounting for 8% of the overall Horizon 2020 budget, with more than €6 billion in funding allocated for 2014-2020 period. The increased EU budget is intended to support more than 65000 researchers, almost 40% of which are expected to be PhD candidates. The funds are helping strengthen EU's research and innovation, contributing to job creation and economic growth in the process.

Androulla Vassiliou (European Commissioner for Education, Culture, Multilingualism and Youth) described this as *'a massive boost for European research and the entrepreneurs of tomorrow'*.

MSCA is the main EU programme for doctoral and post-doctoral training, supporting 25000 candidates including industrial doctorates, joint doctorates, and other innovative forms of research training that enhance employability. The MSCA initiative supports researchers' development and training with a focus on innovation skills in all scientific disciplines and mobility across national and sectors. The MSCA also supports exchanges of research and innovation staff across Europe within partnerships that include both academia and other organisations, as well as exchanges around the world to strengthen international cooperation in research and innovation.

"With the European Institute of Innovation and Technology and the Marie Skłodowska-Curie Actions, the EU is significantly increasing its investment in people with the knowledge and talent to innovate and change lives. This is excellent news for the research community and the EIT's entrepreneurs of tomorrow," EU Commissioner Vassiliou

The aim of MSCA is to train the next generation of researchers in Europe. Researchers working across all disciplines, from life-saving healthcare to *"curiosity-driven science"* will be eligible for funding. It will support researchers, regardless of nationality, at all stages of their careers as well as industrial doctorates, combining academic research study with work in companies, and other innovative training that enhances employability and career development.

The importance of encouraging the pool of talented global researchers to spend time outside academia, in enterprises and other organisations, during their fellowships cannot be underestimated and a move to CEB under the Marie Curie research fellowship scheme can certainly facilitate this experience.

CEB Director of Research, Professor Lisa Hall, adds; *'CEB launched its career incubator in 2009 to offer an exciting environment for early career researchers to become part of a world-leading department. So far, fifteen researchers have come to CEB under this scheme and have gone on to establish their international reputations through leadership positions in UK, Switzerland, Spain, Sweden, Netherlands and US.'*

The MSCA is open to all fields of research and innovation, from fundamental research to market take-up and innovation services. The applicants individuals and/or organisations get to choose the research and innovation fields. Any researcher can apply for an MSCA grant, as long as they have not worked in the host country from more than 12 months in the last 3 years. More information on the upcoming call for 2015 Individual Fellowships on www.ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/calls/h2020-msca-if-2015.html

The MSCA scheme can provide researchers with a wonderful experience in a new research environment and help them gain the necessary skills and international experience to help boost their career. It also gives researchers attractive working conditions and the opportunity to move between academic and other environments including industry. There are several types of MCSA options for researchers to consider but CEB is mainly focusing on increasing the take-up of individual fellowships (IF) and Innovative Training Networks (ITN) to support experienced researchers undertaking mobility between countries, optionally to the non-academic sector.



CEB researcher working in the microscopy lab

CEB very much welcomes applications and opens its doors to talented researchers from around the world wanting to further their career in a top quality research organisation, especially those mainly interested in applying for Individual Fellowships (IF). See more details on www.ec.europa.eu/research/mariecurieactions/about-msca/actions/if/index_en.htm

The MCSA funded research fellowships present a dedicated programme for structuring researcher training whilst promoting mobility and career development. Dr Graham Dransfield, CEB's Knowledge Transfer Facilitator is an experienced Evaluator of FP7 and H2020 proposals. He is extremely aware of the benefits of the scheme

and can give young researchers useful tips on how to help put together a good case for application.

Dr Dransfield comments; *'Some good potential applicants may be put off applying for Horizon 2020 Maria Sklodowska Curie (H2020/MSCA) mobility scheme funding by the apparent difficulty in making a successful bid. I'd like the take-up within CEB to increase and we have planned a H2020/MSCA seminar to help facilitate this aim. CEB will, in fact, host this workshop on Thursday 21 May to address this issue with the help of Dr Renata Schaeffer, the University's European Policy Manager.'*

CEB, a truly multi-disciplinary Department encompassing chemistry, life sciences and materials, is a high quality research-lead host institution with state-of-the-art facilities on offer to inspire the research and innovation of the future in healthcare, energy and sustainability. Therefore, CEB has the advantage of being versatile with regard to funding panel. *'We would then like to receive more applications from gifted young scientists from all over the world, whether they be doctoral candidates or experienced researchers';* adds Graham.

With the Department moving to brand new facilities in its new home in West Cambridge, CEB is also well-equipped and positioned to offer wonderful academic development opportunities. This can help take their research work in new exciting directions and researchers are then very much encouraged to consider applying for a H2020's Marie Curie fellowship to develop their line of research at CEB, a hosting institution of high standing and value .

For researchers considering applying for Innovative Training Networks or Individual Fellowships, see Graham's profile and contact details on www.ceb.cam.ac.uk/directory/graham-dransfield. Also, more information on the MSCA scheme and funding is available on www.europa.eu/rapid/press-release_MEMO-13-1021_en.htm and www.ec.europa.eu/programmes/horizon2020/en/h2020-section/marie-sklodowska-curie-actions

Message from the New CUCES President

Rachel Oldham, CUCES President 2015-2016



The new CUCES Committee. Front row from left to right: New CUCES President Rachel Oldham, Hannah Templeman and Ray Aun. Back row from left to right: Vid Mehta, Mike Ryan and Emma Hall

It is that time of year again when the Cambridge University Chemical Engineering Society (CUCES) committee is changing. Election results have been announced and as I write this, the new Committee is coming into being and settling into our new roles.

First of all, I would like to congratulate the previous Committee on the

excellent job they have done this past year. It has been a great delight to attend all the events that you have put on for us. Christmas dinner and Annual dinner were as brilliant as always. Having not attended Frank Morton sports day last year, I wasn't sure what to expect, but thanks to all the hard work and stress by the committee behind the scenes it was a complete success (even with the early start, controversial t-shirts and rowdy journey home!). This is all without mentioning the many and varied careers events and socials throughout the year. So it is left to me to say a massive thank you to Sam, Betsy-Ann, Beth, Xian Yao, Charles, Chang and Lauren. It's been fun and we look forward to taking over from you. You've left big shoes to fill.

The future Committee is very excited to get started in their new jobs, so let me introduce us. I'm Rachel, a part IIA and your new President. Next we have Vid Mehta, Social Secretary, and Ray Aun, Careers Representative, who are both part I's. Emma Hall, Treasurer, Hannah Templeman, IT & Publicity, and Mike Ryan, Secretary who are each part IIAs. One of the targets for the new Committee is to get all years of the Department more involved and intermingling. As a Committee we plan on being a bigger presence in Department. Be prepared for us coming and ambushing you all at the end of your

lectures! We also plan to start up an internship database. Internships are an important part of Chemical Engineering and it can be challenging when completing applications. We think a database of previous students' experiences will assist future students in their applications.

We are looking forward to taking up our new duties and hopefully we can build on the success of our previous committee while having just as much fun.

CUCES Annual Dinner

Sam Wibberly, Former CUCES President 2014- 2015

Our time as the CUCES Committee sadly came to an end last term; in order to round off a great year we felt the need to go out with a bang at the annual dinner. This year's event was kindly hosted by the Royal Cambridge Hotel, who provided us with a great venue, a sophisticated champagne reception and some scrumptious food. A huge thank you also needs to be said to Shell and Schlumberger for their generous contributions to the evening and of course to our wonderful photographer Airlangga Gunawan for his superb work. The traditional presidential speeches were given by both myself and our future president Rachel Oldham, and of course Dr Barrie's words went down a storm. It's fair to say that the highlight of the evening came through the entertainment. An excellent performance from our live band (featuring Dr Carmine D'Agostino, Isabelle Bush and Andreas Tsangarides) along with music from Ying Teng and some spontaneous karaoke led to a thoroughly enjoyable end to a fantastic evening. It's been an amazing year heading up such a hard-working and dedicated Committee and all that's left to do is to wish Rachel and her team the best of luck for the next year!

Frank Morton Sports Day 2015

Sam Wibberly, Former CUCES President 2014- 2015

On Tuesday 17 February, lectures were officially cancelled. However a group of around 70 undergraduates still arrived at the Department at the rather early time of 5.50am. Of course there can only be one explanation for these events - Frank Morton 2015!

This year's competition was hosted by Birmingham University, who successfully managed to organise a spectacular day for all involved. The morning began with a careers fair on a scale large enough to swamp out the entirety of the Barclaycard Arena. Cambridge, sadly, only managed to catch the tail end of this but it proved to be more than enough time to take home a hoard of freebies.



Cambridge Netball Team

Sport by sport we were then dispatched from the arena and shuttled across the city to various sports venues, ready to compete against 28 other universities from across the UK. Cambridge played hard in every sport; from football to crazy golf, netball to laser quest, there was a plentiful supply of team spirit and there wasn't a weak link amongst the teams. Standout performances were had by the basketball, volleyball and relay teams who each managed to come third in their respective sports. The team of the day were of course the dodgeball team who secured an outstanding second place. The crazy golf team were unfortunately robbed of their podium position due to underhand tactics from another university (who will remain nameless, but may have finished second overall in the competition) so, technically, another third place award for Cambridge there. Not wanting anyone to miss out on the day's activities, the bowling team chose to rename themselves as some departmental members of staff, therefore, congratulations to Professor Slater, Dr Barrie, Dr Hallmark, Dr Rough, Dr Zeitler and Dr Christie for playing a great game.

After regrouping post-sports and making the owners of Wetherspoons incredibly happy with 70 orders for food it was time for the closing ceremony. The winners of the day were Birmingham (unsurprisingly with the home advantage), who were followed by Strathclyde in 2nd and Manchester in 3rd. Cambridge managed to finish in a highly respectable 9th position, which was a monumental achievement considering most of our

competitors had entered teams more than twice the size of our own.

A thrilling few hours were then spent in the Barclaycard Arena where the music was loud and the party was happening. It was then Cambridge's



Closing Ceremony in Barclaycard Arena

turn to be out on the evening's bar crawl to finish off the day with a well-deserved night of fun. Reflex and Walkabout were fitting hosts to our group who were looking particularly fetching in matching team t-shirts. Socialising with universities proved to be one of the day's highlights, particularly with members from Surrey University, who acted as our partners in crime whilst out on the town. The day finished off in Gatecrasher, all was free to let their hair down and have a ball – a truly immense end to a fantastic day. Many thanks go to BP and the Department for sponsoring our coach hire for the brilliant event!

IChemE Undergraduate Project Prize



Dr Rachel Cooke presenting Paul Hodgson with his award

One of our graduates, Paul Hodgson, recently won the Institution of Chemical Engineers (IChemE) Food and Drink Special Interest Group's Undergraduate Project Prize for his CET IIB Research

Project, entitled 'Flow Patterns and Cleaning Behaviour of Impinging Liquid Jets'. He worked along with Michael Smith, under the supervision by Prof John Davidson, Mr Tao Wang and Dr Ian Wilson. Dr Rachel Cooke, the Chairman of the Food and Drink Special Interest Group at IChemE, presented Paul with a £200 cheque and a certificate. She also graduated with a MEng from this department back in 2000 and then gained a PhD here on the rheology and processing behaviour of complex fluids.

CEB Talent Shines at CUE Competition

Two teams from CEB, Longbow-Cambridge Technologies and Cambridge Cardiology are amongst the winners of the Cambridge University Entrepreneurs (CUE) £1k competition 2014-2015. The teams will now go on to enter the £5k competition, where they must convince judges and investors that the idea can fly by producing a 3500 word business plan. *CEB Focus* Editorial Team spoke to the winners:

Longbow-Cambridge Technologies

Dr David Fairen-Jimenez, Royal Society University Research Fellow, Adsorption and Advanced Materials Group



Team Members of Longbow-Cambridge Technologies

Last February, a new spin out company, Longbow-Cambridge Technologies, from our Department was awarded the Cambridge University Entrepreneurs (CUE) £1K competition 2014-2015 in the Technology and Life Sciences category. Longbow-Cambridge Technologies' team is composed of Tian Tian, Andrew Marsden, Thomas Fry, Dr Claudia Percivalle, and Dr David Fairen-Jimenez. In particular, Dr Fairen-Jimenez is a Royal Society University Research Fellow at CEB heading the Adsorption and Advanced Materials Lab (AAM), and Tian Tian is a PhD student at AAM. The technology is based on the use of patented manufacturing technology for the production of mechanically and chemically robust, monolithic Metal Organic Frameworks (MOF) materials. See Research Feature on page 12.

MOFs are one of the most exciting developments in recent porous materials science, and are able to store and release extremely large volumes of gas as a result of their high porosities and large internal surface areas (up to 8,000 m²/g). At the same pressure, a tank filled with a MOF can store 4 - 8 times as much gas as an empty tank. Historically, MOFs have been synthesised as powders, using binder or pressure to shape them into pellets in order to use MOFs in industrial applications. The limitations of these current pelletisation techniques has led David to develop a process for producing mechanically and chemically robust MOF pellets (called 'monoliths') that have superior performance in a number of industries. The patented technology enables the manufacture of MOFs as large pellets without the need for binder or pressure. These monolithic MOFs bring advantages of mechanical robustness, high density, and three times the volumetric capacity of traditional powdered MOFs.

Of the 16 industrial experts and companies that were contacted, the majority provided positive and exciting feedback. In collaboration with Cambridge Enterprise, we are currently working on ramping up production towards kg scale. We also aim to use this new technique to manufacture a range of MOFs to meet the needs of different markets.

Cambridge Cardiology

Jacob Brubert, PhD Student, Structured Materials Group

Aortic Stenosis is a heart condition affecting 6 million people across Europe. The only definitive therapy is valve replacement, traditionally performed via open-heart surgery. Catheter based intervention has significant advantages over open-heart surgery in terms of reduced mortality, hospital stay and recovery time. Unfortunately the design of catheter-based valves make them a once off procedure limiting their use to high risk patients, above 75 years old. Cambridge Cardiology have developed a first of its kind removable transcatheter valve, which makes it possible for catheter based valve replacement to be the standard of care for all patients with Aortic Stenosis.

Cambridge Cardiology is a team made up of Jacob Brubert, Romilde Kotze (both PhD students led by Dr Moggridge, CEB), Ingrid Wong (MBE course, CEB) and Paul De-Sciscio (PhD in CU Engineering).

More information is available on www.cue.org.uk

i-Teams at the University of Cambridge

Amy Weatherup, Visiting Industrial Fellow, Cambridge Computer Lab



i-Teams came to Cambridge through the Cambridge-MIT Institute, which aimed to build links between the two universities. While I was Entrepreneur- in-Residence there, it became clear that University inventors often knew what was needed to commercialise their research, but did not have the time to do it. i-Teams was a methodology that MIT had used successfully, and so we adapted it for Cambridge (UK).

That was in 2006, and we are still going strong! We have worked on over 90 inventions, training of over 600 post-graduates in practical hands-on business skills, and resulting in 27 start-up companies. Eleven of those spin-outs included students or mentors from the original i-Teams.

i-Teams work for a term on investigating the potential of a real university invention, focusing on talking to industry experts to try to identify a tangible market need. They learn from experienced business mentors, guest speakers and from trying it out for themselves.

Many of these projects have come from CEB, and we regularly have CEB students and postdocs participating. Past CEB projects include AQDOT (with the founders attending as students before bringing us their own research as the basis for a project), JustMilk, and Capillary Film Technology.

More recently, we have worked with Dr David Fairen-Jimenez of CEB, who brought us his MOF technology in Michaelmas 2014. His team won the CUE £100 for 100 words competition twice, and went on to win the CUE £1k competition in January. They are continuing to work together to move his technology closer to a commercial reality.

i-Teams in Cambridge runs in every academic term. We run 3 projects a term, selected from across the scientific side of the University, and will accept ideas for future projects at any time. Both the University of East Anglia (Norwich) and the University of Hertfordshire (Hatfield) are trialling their own implementations of i-Teams this year, and we are launching a new Cambridge programme in May in partnership with the Humanitarian Centre- “Development i-Teams” which looks at how to make best use of new technologies in a developing world context. For more information, see www.iteamsonline.org or @camiteams. Amy Weatherup can also be contacted at am678@cam.ac.uk.

CEB Graduate Researchers' Society

Jacob Brubert, PhD Student, GRSoc Chair



Throughout the Lent term, the CEB Graduate Researchers' Society– in collaboration with the Postdoc Society– showcased a selection of informal “Meet the People” talks from PhD students and Postdocs within the Department. The talks take place on alternate Thursday evenings at 5.30pm and we have heard a great range of talks with subjects from every corner of the Department. The Committee of GRSoc has also organised the Graduate Conference, which was held on 21 and 22 April 2015.

CEB GRSoc has also become a way to bring together researchers using similar tools. This term the Latex User Group is getting off the ground. Those interested in joining contact Fabio Fiorelli (ff278@cam.ac.uk).

Bart Hallmark to get Pilkington Prize

Dr Patrick Barrie, Director of Teaching



Dr Bart Hallmark

Dr Bart Hallmark is to be awarded a Pilkington Prize for Excellence in Teaching in June. Every year 12 such prizes are awarded by the University of Cambridge. These prizes, worth £1000

each, were inaugurated and endowed by Sir Alastair Pilkington, the engineer who developed the process for manufacturing flat sheets of glass by pouring molten glass onto molten tin.

One of Dr Hallmark's major contributions to teaching has been as team leader for the CET IIA Design Project since 2010-11. This entails a huge amount of work in preparing a suitable project. Work on the next Design Project starts as soon as the previous one finishes. Discussion on possible topics takes place with the industrial companies within the Teaching Consortium who are prepared to support the project in some way – this might be by providing expert advice, supplying relevant data that is not in the public domain, or arranging a suitable site visit.

In order to prepare the project scope, Dr Hallmark actually does a large part of the design himself from scratch. This then lets him brief the other staff on the design project team and it means that the documentation issued to students has appropriate information. The actual running of the project during Easter term and the marking of it is very time consuming.

While design always has uncertainties associated with it, and glitches will inevitably be discovered when the project is in progress, the smooth running of the Design Project in recent years has been largely down to Dr Hallmark's efforts. Students always say that the Design Project is extremely hard work but that they generally get a lot out of doing it. The project is largely responsible for transforming students from 'naive undergraduates' into engineers who may practise in the real world.

Dr Hallmark has completely rewritten the lectures that cover Process Design and he sets a variety of assessed

exercises for students that contribute to student's understanding of design before they undertake the main project. His work in this area includes teaching use of the UniSim process simulator to CET I students, together with setting CET IIA exercises on a literature survey, distillation column design, process synthesis, and piping and instrumentation diagram/drawings (P&IDs).

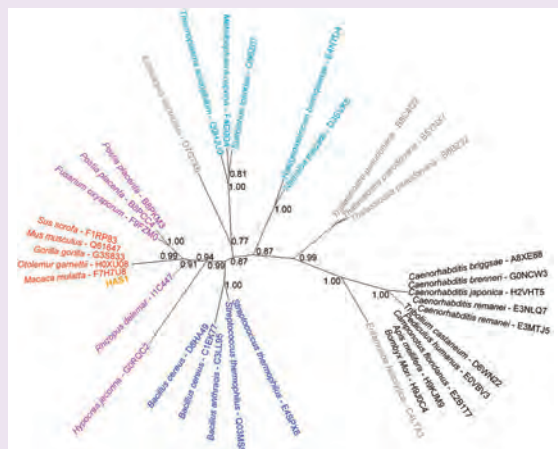
Dr Hallmark's excellence in teaching isn't limited to design. He currently teaches introductory chemical engineering to CET I students, rheology to CET IIB students, and numerical methods to MPhil students in Advanced Chemical Engineering. He has taught other courses in the recent past such as Sustainability and Materials. His lecture courses are always well prepared and students comment favourably on his explanations and enthusiasm. He commented; *'I'm absolutely delighted, surprised and honoured to receive this prize. I've always firmly believed that students at the University deserve to receive the highest quality of education possible, and that it's worth going that extra mile to try and strive to deliver exactly that. I've probably got it wrong more times than I've got it right, but listening to (at times!) constructive student feedback is vital in order to try and make, and implement, incremental improvements. I'd like to thank very much everyone who's supported and encouraged me for the past few years, without which delivery of much of the project-based work would have been so much harder. I'm looking forward very much to riding the new mountain bike that the Pilkington prize has allowed me to build.'*

Dr Hallmark makes a number of other significant contributions that affect teaching within the Department. These include organising the Department's Teaching Consortium of industrial companies. In particular, he gets industrial visitors into the Department so that they can run transferable skills workshops for undergraduates. He also promotes the undergraduate course at Open Days and answers queries from potential students.

The Pilkington Prize Award is in recognition of Dr Hallmark's sustained excellence in teaching in the Department. The formal presentation of the prize will be on 23 June 2015.

Horizontal Gene Presence in both vertebrate and invertebrate Genomes

Dr Alastair Crisp, Cell and Organism Engineering Group



Phylogenetic tree, illustrating HAS1 gene (yellow), vertebrate evolution (red), fungi (pink) and other animals (black)

As well as reproducing and passing on their genes to their offspring (Vertical Gene Transfer - VGT), bacteria can also pass their genes to each other by a mechanism known as Horizontal Gene Transfer (HGT). This allows the rapid spread of advantageous genes, such as genes for antibiotic resistance, so HGT has played a large role in bacterial evolution. However, its role in animals is controversial.

Previous studies have largely focussed on single species and invertebrates. So, for our recent paper in *Genome Biology*, we chose to look at 40 species from around the animal kingdom and in every species we looked at, including humans and primates, we found evidence of HGT. We found some HGT that had previously been detected, but we also identified many new 'foreign' genes and the number was markedly greater than seen before. For example, the HAS1 gene (yellow) was acquired early

in vertebrate evolution (red) from fungi (pink), as shown in this phylogenetic tree from our paper where they group together. If the genes were acquired by VGT, and the other vertebrate genes, it would group with the other animals (black). These foreign genes come from bacteria, fungi and other single-celled organisms, and mostly control biochemical functions.

In humans, some of the genes were involved in lipid metabolism, including the breakdown of fatty acids and the formation of glycolipids. Others were involved in immune responses, including the inflammatory response, immune cell signalling, and antimicrobial responses, while other gene categories include amino-acid metabolism, protein modification and antioxidant activities. Genes we identified included the ABO blood group gene, which has previously been reported as foreign, and 126 new genes.

Our findings suggest that rather than being confined to simpler, single-celled organisms (e.g. bacteria) or to specific relationships (e.g. host-parasite pairings), HGT may occur in all species, even in humans. According to Alastair "this means we need to re-evaluate our evolutionary models to take into account the contribution of HGT." A better understanding of HGT and the mechanisms underlying it may provide new insights into how genomes evolve, including our own.

Networking through Catalysis



Professor Matthew Gaunt and Professor Alexei Lapkin, Director of Catalysis@Cambridge

On 14 April 2015 Catalysis@Cambridge hosted the first Showcase and Networking Event which brought together a number of Cambridge academics, researchers and around 50 industry representatives, including GlaxoSmithKline, Shell, Pfizer, Sabic, Aramco, Merck, and Johnson Matthey. The event was supported by Energy@Cambridge Strategic Research Initiative and funded through the EPSRC Impact Acceleration Account. Leading academics highlighted recent discoveries and new approaches to catalysis and catalytic reaction engineering in a series of short presentations, and chaired a series of parallel round table discussions exploring challenges in catalysis in several key areas including energy, materials science, biocatalysis, synthesis and continuous processing, which will feed into future industrial consortium projects.

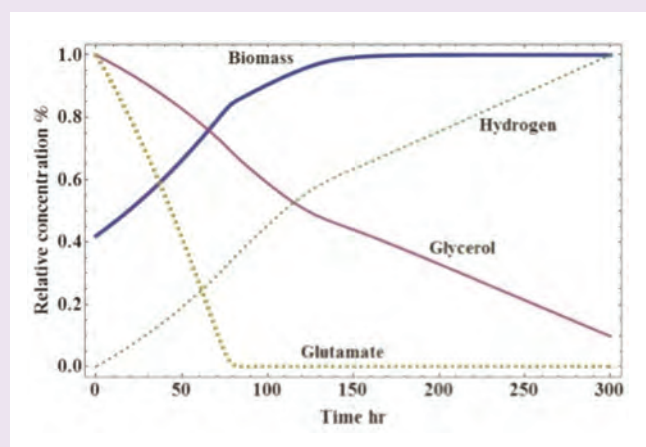
Led by the directors Professor Matthew Gaunt, Department of Chemistry, and CEB Reaction Engineering Professor Alexei Lapkin, Department of Chemical Engineering and Biotechnology, Catalysis@Cambridge, as a virtual centre, incorporates over 30 academics from the Schools of Physical Sciences and Technology and aims to create an international flagship for training and research. It seeks to provide a transformative approach to catalysis and synthesis research by harnessing the world-leading expertise from across the University of Cambridge to develop and apply new pioneering catalysis concepts that will have a future impact on health, energy, the environment and new materials. According to both Directors *'Today's event underlines the importance of catalysis research in both academia and industry and we hope our centre can provide a platform for exciting new collaborations.'*

Catalysis@Cambridge will provide future opportunities for collaborative activity and training, workshops with industry, engagement opportunities for students and entrepreneurship experience. Enquiries about Catalysis@Cambridge centre should be directed to catalysis@ch.cam.ac.uk.

Modelling and Optimisation of Biohydrogen

Dr Vassilios Vassiliadis, Process Systems Engineering Group

Cultivation of micro-organisms for biofuel production is being widely researched at present. Amongst different biofuels, biohydrogen generated by cyanobacteria and purple non- sulphur bacteria (PNS) has drawn great attention. Despite the extensive study of biomass cultivation and biohydrogen production, scaling up these processes from laboratory setup to industrial production is still an open issue. For scaling up processes, good understanding of the underlying mechanisms is necessary in order to produce accurate models, and more particularly, capturing process dynamics. The dynamic simulation of biohydrogen generation process faces mainly two challenges. First, few kinetic models are capable of simulating all the different phases of fermentation, from growth to hydrogen production. Second, it is difficult to estimate model parameters accurately due to both the nonlinearity and dynamic nature of associated process models. To overcome these difficulties, the current study investigates a series of models derived from the Droop Model. The aim is the dynamic simulation of biohydrogen production by different species, including cyanobacteria and PNS bacteria. All the models are found to represent the underlying dynamic process very reliably and accurately. Using these models, the effects of incident light intensity, light attenuation, temperature and limiting- nutrient concentration on gas production are extensively



Dynamic performance of the optimised batch process

encouraging results obtained in the work presented here, ongoing efforts are focused on high-density biomass cultivation optimisation using the principles established for biohydrogen productivity maximisation.

explored in the current work. Because biomass growth and biohydrogen production maximisation are conflicting objectives, the current models have been used to determine the optimal operating conditions of different short-term (30-day) industrially relevant processes aiming to maximise biohydrogen production. Both traditional off-line optimisation and novel on-line optimising control techniques (Model Predictive Control, MPC) are investigated. A significant increase of 116% on gas production is predicted computationally, through the optimisation of operating conditions of the process. The constructed dynamic models are also employed in the design of photobioreactors and the economic analysis of a pilot scale cyanobacterial hydrogen production process. Following the very

How can computational Methods help to find new, better, bio-compatible Drug Carriers?¹

David Fairen-Jimenez, Adsorption and Advanced Materials Group

The study of the molecular mechanisms that control drug delivery in porous systems is of critical importance to nanomedicine applications, where nanotechnology has the potential to revolutionise cancer diagnosis and therapy. Indeed, a fundamental, yet unresolved problem in many therapies including cancer treatment is that many routinely used therapeutic agents present a high-level concentration within the first minutes after dosing followed by low-levels in the next hours.

Nanomedicine systems aim to improve the biodistribution of therapeutic agents, so the efficacy of the intervention can be increased while its toxicity is attenuated. To develop therapeutic agents that can achieve this aim, a large number of drug delivery systems have been suggested in recent years. However, most of the proposed routes suffer from important drawbacks such as low drug capacity or poor control of release kinetics.

Recently, metal-organic frameworks (MOFs) have been proposed as nano-carrier platforms for drug-delivery.² MOFs are obtained by the self-assembly of metal clusters and organic linkers, resulting in tailored nanoporous host materials with pore sizes up to 6nm. MOFs with extraordinary pore volumes show great promise in nanomedicine applications due to their interesting porous and structural properties. One of the most striking advantages of MOFs over more traditional porous materials is the possibility to tune the host/guest interaction, not only varying their pore size but also by functionalising the building blocks with chemical groups, providing the possibility to control the kinetic release of a therapeutic agent. MOFs offer extremely high drug capacity (e.g. up to 1.4 g of drug per gram of porous solid) of several therapeutic agents.³

Given the many different MOF structures, a systematic study of their performance in drug delivery is essential to identify promising structures. Molecular simulations provide an outstanding tool to predict the performance of the materials and, thus, to select the optimal structures for a given application. Grand canonical Monte Carlo (GCMC) simulation is the work horse for simulating adsorption in porous materials, explaining

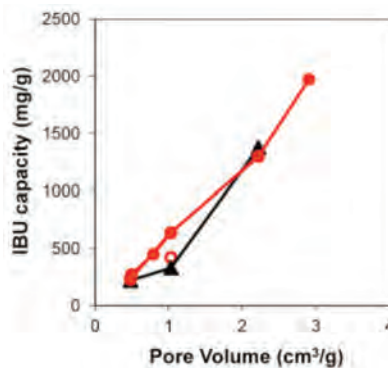


Figure 1. Simulated (red circles) and experimental (black triangles) ibuprofen capacities for the selected series of MOFs vs. their calculated pore volumes. Red open circle represent the simulation on MIL-100 with blocked cavities.

and predicting new experimental results. However, the simulation of large guest molecules, e.g. a drug, is difficult because of the tight fit of the molecules in the pores. As a consequence, reported modelling studies on drug-porous solid systems are rather scarce. To the best

of our knowledge, this is the first time that a systematic study has been carried out to study the adsorption mechanisms of drugs on MOFs, and to analyse the influence of the MOF textural properties in the drug adsorption-delivery phenomena on MOFs.

Grand canonical Monte Carlo

We used GCMC simulations to screen a series of bio-compatible MOFs as carrier systems of a model drug, the anti-inflammatory and analgesic ibuprofen, IBU. We validated our results with available experimental data reported for the adsorption-release of ibuprofen in MIL-53, MIL-100, and MIL-101. We extended our study to three novel bio-compatible MOFs based on non-toxic metals, MOF-74(Mg), edible carbohydrate linkers, CD-MOF1, and outstanding pore volumes, BioMOF-100. The MOFs were also chosen to represent a wide range of textural properties: MIL-53, MOF-74 and CD-MOF-1 are microporous materials; MIL-100 and MIL-101 are mesoporous materials with narrow microporous windows; BioMOF-100 is a strictly mesoporous MOF. We focused on the maximum adsorption capacity of each MOF; the shape of the simulated adsorption isotherms (e.g. the existence or not of steps during the adsorption process); the siting of the drug molecules in the porous structures through the analysis of snapshots

and radial distribution functions (RDF); and the loading-release dependency on the average potential energy of adsorption (U_{gh}) of IBU inside the MOFs. We explored these materials as potential drug vehicles by comparing their performance with state-of-the-art MOFs for such application.

Drug capacity screening

To validate our simulations, we first compared the trends obtained between pore volume and maximum loading. Figure 1 (on the previous page) shows an excellent agreement. Remarkably, BioMOF-100 presents an outstanding IBU capacity of 1,975 mg/g. When comparing with experimental data, the simulated capacities for MIL-53 and MIL-101 perfectly match the experimental values with differences below 6 %. In contrast, the experimental maximum loading of MIL-100 falls under the general trend, being almost half (i.e. 48 %) of the simulated value. MIL-53 shows regular channels of *ca.* 7.4 Å diameter, whereas MIL-101 shows spherical mesoporous cages accessible through pentagonal and hexagonal windows of *ca.* 12 and 16 Å. In both cases, the accessibility of IBU molecules (*ca.* 5 x 10 Å size) to the material's porosity should be easily achievable. On the contrary, the spherical mesoporous cages of MIL-100 are connected by narrower cavities: the larger ones by *ca.* 8.5 Å hexagonal windows and the smaller ones by *ca.* 5 Å. In this case, the accessibility to the smaller mesoporous cages might be kinetically impeded by the narrow size due to the dynamic uptake process. This phenomenon is in principle not captured by GCMC simulations, where the entire void volume, accessible or not, is taken into account during the simulation. In order to confirm the existence of dynamic issues during the filling process that could justify the difference in the simulated and experimental uptake values, we ran a new simulation on MIL-100 blocking the adsorption of IBU in the smaller mesoporous cavities. The most appreciable difference in the new isotherm is a significant decrease in the maximum loading down to 403 mg/g, much closer to the experimental capacity.

Drug adsorption mechanism

The profile of the simulated isotherms (not shown) can be understood in terms of different adsorption regimes. On one hand, for microporous MOFs (MOF-74 and MIL-53) there is very little uptake at low pressure,

followed by a sharp jump in the loading corresponding with the saturation of the porosity. This phenomenon is characteristic of systems where the adsorbate-adsorbent interactions are strong relative to the adsorbate-adsorbate interactions. On the other hand, simulations on wider porous BioMOF-100 reveal a typical gradual filling adsorption process of a mesoporous material. Figure 2 shows the formation of a monolayer of IBU on the surface at very low loadings, followed by a multilayer filling process until *ca.* 50 % of the total uptake. After, a condensation of the IBU molecules in the centre of the pores takes place.

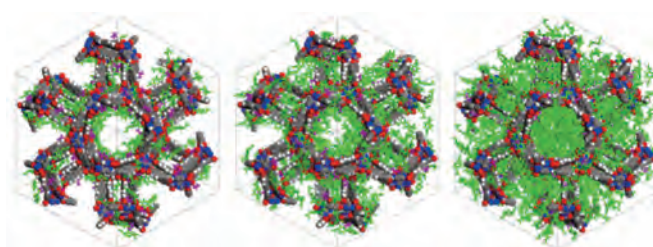


Figure 2. Snapshots of ibuprofen in BioMOF-100 at different uptakes: 329 mg/g (left), 1095 mg/g (centre) and 1975 mg/g (right). Ibuprofen molecules are shown in green stick-mode.

Conclusions

We have used GCMC simulations to study the capacity and thermodynamic adsorption process of the model drug ibuprofen in state-of-the-art MOF materials. Our methodology allowed us to obtain a successful prediction of the drug adsorption properties of porous adsorbents. As a result, the comparison of the simulated capacities with the experimental reported values was highly consistent for MOFs with different pore geometries. In addition, GCMC simulations allowed us to study new porous materials as potential drug carriers before running any experiments, predicting outstanding IBU capacities of up to 1969 mg/g, six times higher than values found in mesoporous silicas. This work represents a complete GCMC simulation study that systematically analyses a set of MOF systems as potential drug carriers, proposing new tools for the corroboration of new, future experimental results.

References

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2. P. Horcajada et al., *Nature Mater.* 2010, 9, 172.
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CEB Design Project: Design Education through Teamwork



2014 Design Project Winners (left to right)
Csaba Katai, Jenny Parkin, Andrew Lowson,
Simon Fox from Mondelez, Beth Jones and
Kaichen Gu

Easter Term sees the annual launch of the CEB undergraduate design project. The design project is an important component of the third year (CET IIA) syllabus, consisting of just over 23 % of the third year grade and 70 % of the continually-assessed marks for that year. It is also an important qualifying criterion in the eyes of the IChemE: a pass in the design project allows graduating students to become chartered engineers in later years without having to go through additional IChemE assessment.

Bob Skelton, now a retired lecturer, introduced the current format of the Cambridge design project in the early 1990s - students are put in teams of five or six and have to work together to produce a design for a specified chemical process. The teams are chosen in such a way as to balance academic ability, educational background, gender and collegiate affiliation.

Each student looks after the front-end engineering design (FEED) of a section of the process along with the co-ordination of a particular aspect of process strategy; the latter could include, for example, carrying out the HSE audit of the entire plant or co-ordinating the plant process control strategy. Effective teamwork, good interpersonal communication and close collaboration between team members is a vital pre-requisite to being able to complete these tasks efficiently and to a high standard. Past students have commented that one of the most challenging aspects of the project is working effectively with peers that may not normally be part of their usual social group!

Previous design projects have included: designing a process to produce 260,000 tonnes per year of ammonia, with a specific focus on safety and energy efficiency; designing a plant to produce 20,000 tonnes per year of an organophosphate herbicide, n-phosphonomethylglycine (PMG) and designing a plant to produce 10,000 tonnes per year of instant, freeze-dried coffee. Where possible, design projects are supported by corporate members of CEB's Teaching Consortium (see www.ceb.cam.ac.uk/undergraduates/teaching-consortium). This year's project is supported by ABB. ABB is probably best known for being a global leader in power and automation technologies, but it also has an extensive portfolio of products and services for the chemical industries. Of particular relevance to this year's project is their expertise in natural gas dehydration technologies.

This year's design project concerns the processing of sour, North Sea gas, to a specification suitable for injecting into the UK gas grid. The wellhead is assumed to be located in the high pressure, high temperature, Elgin-Franklin field in the northern North Sea and the gas is assumed to have an augmented hydrogen sulphide content that is comparable to some Canadian natural gases. The objective is to examine the feasibility of a sour natural gas processing flow-sheet under the scenario of future legislation that may outlaw hydrogen sulphide flaring on production rigs.

The current CET IIA class will devote five weeks of Easter term to find a suitable solution to the design problem. They will be handing in their reports on the 4 June and each team will also be giving a ten minute presentation on their design to department members and representatives of both ABB and IChemE on the 5 June (2-5pm, LT1). All members of the Department are welcome to attend these presentations to find out how this year's class has fared!

In training the engineers of tomorrow, CEB heavily encourages and promotes 'innovation' in the classroom, with Design Project teamwork as a extremely valuable element that helps improve student experience and fine-tune problem solving skills also facilitating student innovative thinking in the process.

Company Highlights

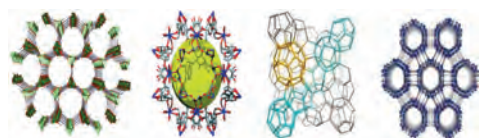
Conversations continue with numerous companies. See an overview of the latest developments below:

INVISTA



INVISTA is one of the world's largest integrated producers of polymers and fibres. They own everyday brands, such as LYCRA® fibre and STAINMASTER® carpet. Their Vice President of Sustainability, Dr Gary J. Smith, is a CEB alumnus himself.

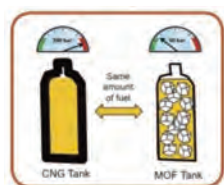
INVISTA became the latest company to join the Teaching Consortium in January 2015. The relationship is already progressing gas fermentation-based processes to form industrial chemicals.



MOFs

One particularly exciting area is Metal Organic Frameworks (MOFs). MOFs are a new class of nanomaterial, a bit like graphene, but with their own distinctive potential range of applications. MOFs have the

capability to make drug delivery less toxic, enable cheaper separation of toxic gases and make gas storage four times more efficient. MOFs has already provoked a great deal of interest from several oil, chemical and pharmaceutical companies. See more information in the Research Feature (P.12).



MOFs inserted into a gas canister reduces the pressure by 75%.



Woolcool

Woolcool was launched in 2008 and the innovative, sustainable design has scooped an impressive haul of awards in the packaging, business and environmental arenas. Woolcool remains the only range of sheep's wool insulated packaging available on a commercial scale. Woolcool continues to outperform conventional insulating materials and they are leading the way in providing natural, sustainable insulated packaging for the food and pharmaceuticals sectors in the UK and also worldwide.



Woolcool insulated box

Every year since 2012 they have been awarded funding from the UK Government backed Innovate UK to further the research and development of Woolcool technology specifically for the pharmaceuticals sector and the transportation of highly temperature sensitive vaccines, along with other areas, such as transplant organs, blood plasma and stem cells.

During 2015, Woolcool are very excited to be working alongside CEB in order to further research the remarkable insulating properties of sheep's wool.

Impact

Another New Spin-out Company - Cambridge Sensor Technologies Ltd

Cambridge Sensor Technologies Limited (CST) has been formed to exploit the technology developed by Dr Mark Williamson, a lecturer and researcher at the Department. Frontier IP has entered into an agreement with CST in which it has agreed to provide advisory and business development services in return for an equity stake in the new company.

Dr Mark Williamson develops heating system, sensors and control strategies for industrial processes in which the composition of the processing atmosphere is important. The benefits of the technology include significant reduction in energy consumption and improvement/optimisation of the quality and consistency of the manufactured goods. A programme of industrial trials is already underway, in collaboration with major multinational companies in the food and speciality chemicals sectors.

Events



Event Review: Stevenage Bioscience Catalyst

Wednesday 21 January 2015

The workshop aimed to delve deep into the grand challenges which present across all sections of the life sciences community. Beginning with the eternal conundrum of money and identifying funding sources, scaling your innovation from lab to commercial production, building consortia which weave industry and academia into meaningful and successful ventures, all the way to novel solutions for drug delivery.



Dr Krish Mahbubani leading a syndicate discussion

It proved to be an excellent day, which was both enjoyable and engaging. Over 40 people attended from numerous Cambridge departments, ranging from engineering to pathology, and 10 delegates from SBC. The afternoon sessions were brimming with ideas.

Stop press: A reciprocal event, which will explore these ideas and give students and post-docs an opportunity to meet key personnel from Stevenage, including resident companies, is being planned for Wednesday 17 June. Please make a space in your diaries.

Catalysis@Cambridge Showcase Event

Tuesday 14 April 2015

This event was jointly organised by CEB Professor Alexei Lapkin with Chemistry and Materials Departments and with help from Syngenta. A full report on proceedings will be included in the next edition of *CEB Focus Newsletter*.

H2020/MSCA Seminar

Thursday 21 May 2015, 2pm, Pembroke Street building, LT2

Some talented scientists may be put off applying for Horizon 2020 Maria Skłodowska Curie (H2020/MSCA) mobility scheme funding by the apparent difficulty in making a successful bid. An H2020/MSCA Seminar in-house will outline the funding opportunities available and answer important questions to help make a successful application.

Dr Renata Schaeffer, Cambridge University's European Policy Manager, will give an overview of the H2020 Programme, while Dr Graham Dransfield will draw on his experience as an MSCA Evaluator to give you valuable tips on how to improve your chances of getting funded.



The workshop is aimed at principal investigators looking for talented researchers and international collaboration as well as Postdocs and PhD students considering their next career move and final year and Master students thinking of doing a PhD abroad. All researchers are welcome to attend this informative and participative session.

More information on www.ec.europa.eu/programmes/horizon2020

CEB HoD appointed Pro Vice-Chancellor



Professor Nigel Slater on duty at his office desk

The University Council appointed three new Pro-Vice-Chancellors (PVCs) in January, who will take up their positions over the next few months. They are Professor Nigel Slater, Professor Eilis Ferran and Professor Chris Abell. These latest key appointments will provide support and leadership to the Vice-Chancellor over a period of growth and opportunity for the University and Cambridgeshire.

They will join Professor Graham Virgo (PVC for Education), who took up his post last October, and Professor Duncan Maskell, when he starts as Senior PVC in August 2015. The five PVCs are responsible for taking forward the University's strategy and policy development and supporting the Vice-Chancellor in his role in providing leadership to the University with each post covering different areas of strategic importance to the University.

Professor Slater, currently Head of CEB and Principal Investigator leading the BioScience Engineering Research Group, will not take up his new appointment as PVC for Enterprise and Regional Affairs until 1 January 2016. He is Professor of Chemical Engineering and a Fellow of Fitzwilliam College.

Professor Ferran, whose appointment takes effect on 1 October 2015, will focus on Human Resources and provide oversight of the University's international affairs. Professor Abell will take up his appointment on 1 January 2016, focusing on research. The new PVCs will take over from Professor Jeremy Sanders (Institutional Affairs), Professor Lynn Gladden (Research) and Dr Jennifer Barnes (International Strategy).

More information on www.cam.ac.uk/for-staff/news/university-appoints-new-pro-vice-chancellors

Professor Lynn Gladden elected to US NAE



Professor Lynn F. Gladden, Pro Vice-Chancellor for Research

Professor Lynn F. Gladden (CBE), Pro-Vice-Chancellor for Research, Shell Professor of Chemical Engineering and former Head of this Department, has been elected to the US National Academy of Engineering (NAE) as a Foreign Member.

Election to the National Academy of Engineering is among the highest professional distinctions to be awarded to an engineer. Academy membership honours those who have made outstanding contributions to *'engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature,'* and to the *'pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education.'*

Professor Gladden has been elected for her contributions to chemical reactor engineering through the uniquely specific application of magnetic resonance imaging.

Two CEB alumni, Gavin Towler and Graeme Jameson, have also been elected. Gavin P. Towler was elected for process designs for commercial petrochemicals and for leadership in refining and chemical research. Graeme John Jameson was recognised for development of innovative flotation technology for advanced mineral processing. NAE has elected 67 new members and 12 foreign members, bringing the total U.S. membership to 2,263 and the number of foreign members to 221.

More information on www.nae.edu/Projects/MediaRoom/20095/130169/130172.aspx

Professor Clemens Kaminski elected to Optical Society



Professor Clemens Kaminski

Professor Clemens Kaminski was elected as a Fellow of the Optical Society of America (OSA) in recognition of *'pioneering work in the development of optical methods for quantifying the kinetics of reactions in chemical and biological systems'*.

Professor Kaminski started his career developing optical imaging techniques for the study of thermochemistry in turbulent combustion systems and he developed a method that permits researchers to 'film' the progress of fast exothermic reactions in real time.

Over recent years he has been focusing on the development and application of modern imaging techniques in the study of molecular mechanisms of diseases, trying to understand the processes that cause proteins to misfold and aggregate causing diseases such as Alzheimer's and Parkinson's.

He commented; *'I am grateful and privileged to work with such an exceptionally talented and motivated research team - it's their hard work and achievement that is being recognised. It's an exciting time for photonics research and we are only beginning to unleash its potential to study chemical phenomena at the molecular scale'*.

OSA is the world's leading professional organisation in optics and photonics, with more than 18000 members worldwide. Every year the OSA proposes about 70 new Members worldwide, who have served with distinction in the advancement of optics and photonics to be elected as a fellow. More info on www.osa.org

Bio Grad Entrepreneurial Wins

Biotechnology alumnus Dr Darrin Disley (PhD Biotechnology 1991-96) is a serial life science entrepreneur who has been involved in the start-up and growth of numerous business ventures. His primary role is CEO of Horizon Discovery Group plc, one of the Cambridge region's leading life science companies and now an international entity employing more than 200 staff in the UK, Austria and the United States.

In January of this year Dr Disley's business achievements were recognised at the annual Quoted Company Awards, where he was named Entrepreneur of the Year 2015. The Quoted Company Awards recognise the achievements of companies listed outside of the FTSE 350, and their key directors. The accolade followed Dr Disley being presented with the Executive of the Year title at December's SCRIP Awards, which are among the most prestigious in the calendar for the life sciences industry. The Executive of the Year Award acknowledges excellence in the leadership of large and small pharmaceutical and biotechnology companies.

'To be recognised as an innovator and leader by my peers twice over is a tremendous honour' said Dr Disley. *'Since listing on LSE's AIM in March 2014 Horizon has gone through an incredibly dynamic and exciting time. It is testament to my colleagues that we have had such success and are positioned well for the future. It is a privilege to be heading such a dynamic company'*; he added.

Dr Disley is also very active outside of his role at Horizon, investing in and providing guidance and mentoring to promising young companies. He is a strong advocate of the UK Life Sciences Sector and is a frequent speaker on the topic. Within Cambridge Dr Disley is also actively involved in the Professor Christopher R Lowe Carpe Diem Enterprise Fund and is an



Dr Darrin Disley at Horizon's listing at the London Stock Exchange

Entrepreneur in Residence at the Judge Business School, as well as taking on the role of Enterprise Fellow here at the CEB.

Recollections from Dr Miles Kennedy



Dr Kennedy completed his undergraduate Degree at the University of Canterbury in Christchurch, New Zealand. In 1951, he started his PhD at the Chemical Engineering Department at Cambridge University. In 1965, he was appointed Professor and Head of the Chemical Engineering

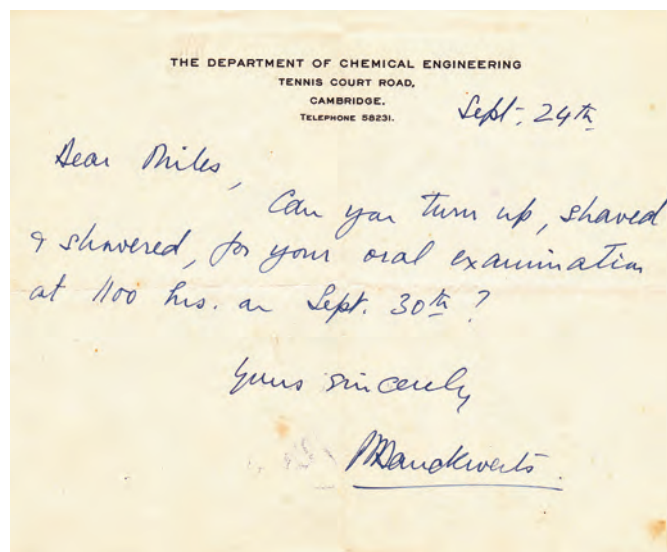
Department at the University of Canterbury in Christchurch, New Zealand. He retired from the university as its Deputy Vice-Chancellor in 1993. He is a Distinguished Fellow and past-President of the "Institution of Professional Engineers, New Zealand".

On 6 September 1951, my wife and I found our way to the Chemical Engineering Department on Tennis Court Road. (We had been married for two months, with half that time having been spent at sea, travelling from New Zealand). The only person there was Dr John Kay, who showed us around the laboratories. Compared with the dingy basement laboratories and workshops where students at Canterbury College in Christchurch (NZ) were introduced to the art and practice of Chemical Engineering, the facilities at Tennis Court Road seemed quite splendid. After our tour, Dr Kay took me and my wife back to his house for tea – bread and raspberry jam as I recall.

A week later, Professor Fox was back from holiday and I had the first of several inquisitorial sessions with him. I was the second research student in the department (Dr Denbigh's PhD student, Peter Caudle, had already finished) and the first from overseas and Professor Fox probably wanted to be assured that, in accepting me, his formidable standards would not be breached. In the event, he passed me over to Mr Danckwerts – probably with some misgivings. And so I became the first of a long line of graduate students to be supervised by Peter Danckwerts. In October, two more research students appeared on the scene - Derek Augood, who worked with Mr Sellers, and John Lee, who was Peter Gray's student.

The three of us were allowed to take our morning and afternoon tea with the staff. And what a group that was.

Terence Fox, of whom most of us were terrified (me in particular when his Secretary, Margaret Sansom, came out one morning to say I had better hurry as a glass fishtank in my small laboratory, opposite the professorial suite, had shattered and strong caustic soda solution was heading across the corridor to the great man's room); Stan Sellers – always imperturbable and a wonderful front-man for the department; Kenneth Denbigh – a splendid lecturer and a very witty person; and John Kay – also a great lecturer and very jolly. He would go into fits of laughter when Danckwerts took himself off to his office to try out yet another experiment for a book he and his brother were writing on things a small boy could do – I don't believe it was ever published.



Dr Kennedy's summons for his PhD viva



Professor Fox (middle) and Dr John Kay (right) with unidentified student (left) at the CEB site on Tennis Court Road.

Peter Gray was a good friend - he would take me off for a walk along the Fen Causeway if he thought I had been incarcerated in my laboratory-cum-office for too long. And then there was Peter Danckwerts. I was very much in awe of him until one evening when he invited my wife and me for supper which consisted of neat gin (or gin with water if we preferred), and chestnuts roasted over a bunsen burner. He unbent quite a lot that evening and we were on good terms thereafter.

Before long, this formidable group was joined by John Davidson and Denys Armstrong. Looking back, one wonders whether there has ever been a group of academic staff in a single department, who have gone on to have such an influential role in Chemical Engineering – not just at Cambridge, but in the profession at large.

As research students, we were well looked after by the incomparable Margaret Sansom, and by a first-rate technical staff, headed by Derek Suttle. The technicians seemed able to fabricate any piece of equipment we needed, and they built some very elaborate rigs for the final-year student projects. We did have some difficulty with the technician who controlled the chemical stores and the darkroom; skeleton keys were cut and, for a time, we did our photographic work well after normal working hours. Sadly, Professor Fox, whose concern for safety was almost obsessive, soon put a stop to that.

For the first year or two, money seemed to be no object. We could order equipment or materials without hindrance. This changed, of course, as student numbers grew. By Michaelmas term 1953, there were about 16 graduate students, including ones from Canada and Australia, and undergraduate numbers had doubled. Inevitably, restrictions on purchasing were put in place, and the informality of our earlier years gradually disappeared. But by then, Augood, Lee and I were trying frantically to finish our experiments and get our theses written. I was working in London by the time I was summoned for my oral examination (in a rather less formal fashion than would be the case nowadays). And our homeward-bound ship was nearing the Panama Canal when I learnt that I would be admitted to the PhD degree.

Obituary for Dr Geraldine Rogers



Dr Geraldine Rogers

It is with great sadness that we record the death of Dr Geraldine Rodgers, who was associated with the Institute of Biotechnology for over twenty years, most recently as a lecturer on the Bioscience Enterprise programme

and in her finance professional capacity. Geraldine joined the University from industry in 1994, initially as Business Manager at the Institute and she concluded her career as Head of Cambridge Enterprise Seed Funds, where she had responsibility for managing an equity portfolio comprising almost 70 companies and spanning all technology sectors. She is acknowledged as a key figure in the founding of many successful life science and other technology companies, including Horizon Discovery, Genapta, Sentinel Oncology and BlueGnome.

In 2004 Geraldine was seconded back to the Institute to run the Bioscience Enterprise Postgraduate Life Science Business Programme, a role in which her expertise in technology commercialisation was invaluable. In a relatively short period Geraldine reshaped the syllabus and strengthened the teaching team through introductions to her network of experts in business and life sciences, laying the foundation of the course as it is provided today. In her investment capacity Geraldine continued until her retirement to actively engage with Institute spinouts and she remained a close mentor to both staff of the Bioscience Enterprise programme and students undertaking the internship component of the course. The department is grateful for the many messages of condolences received from her past students and joins them in mourning a wonderful colleague and friend. Without Geraldine much of the success attributed to the Institute would not have been accomplished and we are greatly indebted to her.

First Year Seminars 2015

(CEB, Pembroke Street, LT1, 2.45pm- 5.00pm)

First year PhD students will give an insight on their research projects. The first session was held on Wednesday 29 April 2015. Session 2: Wednesday 6 May 2015, Session 3: Wednesday 13 May 2015, Session 4: Wednesday 20 May 2015 and Session 5: Wednesday 27 May 2015

OneStart Europe 2015 Finals Gala



Grand Connaught Rooms, London WC2B 5DA

Thursday 14 May 2015 at 6.00pm: Cambridge Cardiology is proudly representing CEB finalists through Jacob Brubert, Romilde Kotze (PhD students in the Structured Materials Group) and Ingrid Wong (MBE Course). Paul De-Sciscio (PhD student in CU Engineering) is also part of the team. Oxbridge Biotech Roundtable (OBR) in partnership with SR One is organising OneStart, the world's largest life science startup accelerator programme. The winner of OneStart Europe 2015 Finals Gala is entitled to £100k, free lab space and extensive follow-on mentoring².

² www.onestart.co

Presentation on Horizon 2020 Maria Skłodowska-Curie Actions (H2020/MSCA) Fellowship Applications

(CEB, Pembroke Street, LT2, 2.00pm)

Thursday 21 May 2015: Dr Renata Schaeffer, Cambridge University's European Policy Manager, will give an overview of the H2020 programme, while Dr Graham Dransfield, CEB Knowledge Transfer Facilitator, will give valuable tips on maximising chances for securing funding, as an MSCA Evaluator.

CEB Lunchtime Career Talks

Easter Term (CEB, Pembroke Street, LT1, 1.00pm)



Thursday 28 May 2015: Dr Dan Cooney, Patent Attorney (J A Kemp) and Chemical Engineer, "*Careers in IP*".

Dr Dan Cooney joined J A Kemp in 2007 and became an associate in 2011. He is responsible for supervising the training of trainee patent attorneys at J A Kemp towards qualification as European and UK patent attorneys. He has lectured on 'Intellectual Property Rights and Product Design' as part of the MEng Course at the Department¹.

¹ J A Kemp, 2014.

Open Day for Year 12/13 (Sixth Form Students)

Prospective students will have a chance to visit the Department before applying. Talks on Chemical Engineering, coupled with tours of the Department will be available to prospective applicants during the two University Open Days, 2 July from 10am to 3 July 5pm.

CEB Careers Panel Event

Michaelmas Term 2015



October 2015 (Date to be confirmed): CEB together with Cambridge Chemical Engineering Society (CUCES) organises the Careers Panel Event. Department alumni and captains of industry visit CEB to tell undergraduate about their professional experiences and advise on career paths to follow.

CEB Focus Leaving Editors

In this edition we feature our leaving editors Jantine, Fanny, Kaichen and Chang. We would like to thank them for their very valuable contribution to CEB Editorial Team and wish them the best in their future endeavours. Meet our new editors Aazraa, Noha, Geertje and Hannah in the next issue!



Jantine Broek

I've always been interested in the molecular basis of brain functioning and how this relates to behaviour. The aim of my PhD research is to understand the molecular and physiological changes in autism spectrum disorders. Studies that I have carried out focus on the underlying protein make-up of pre-clinical and clinical models and how the molecular changes affect neurotransmission and cellular dynamics. Joining the *CEB Focus* team was a great way to get to know the activities and the different types of research carried out at CEB. As I am interested in public outreach, editing for *CEB Focus* is a brilliant opportunity to write scientific articles for the public. Altogether, editing for *CEB Focus* is a great, fun and useful experience.



Kaichen Gu

As a IIB CEB student, I joined the team because I thought it would be a good way to explore our department whilst meeting new people. I really enjoyed my time with the extremely supportive team members. It was a rewarding experience to work together on collecting the bits and pieces within a very limited time frame. *CEB Focus* hosts a diverse range of topics. For an undergraduate student like me, who consider research as a possible future career, it provides a great platform to get involved to learn more about our current staff and fascinating research activities going on around the department. Lastly, I just want to wish the best of luck to our new team!



Fanny Yuen

I am a PhD student researching the protective role of intrinsically disordered proteins from desiccation-tolerant organisms. Working on the *CEB Focus* team gave me the opportunity to interact with all corners of our Department and to help highlight and celebrate our many achievements. I usually think of *CEB Focus* as a tea-time reading within CEB, and rarely think of its wide impact and the diverse readership. I was rather caught by surprise when an alumnus pointed out one of our errors. I am sad that my tenure on the team is coming to an end, as I have had the honour to work alongside amazing people and cannot thank them enough for their hard work. Our magazine is in great hands, and I look forward to reading the *CEB Focus* as an alumna.



Chang Yi

I have been working with *CEB Focus* as a representative for CUCES, editing the Undergraduate Focus sections. When I first heard about working for CEB Focus, I was quite uncertain about the idea. But throughout the year working with the team, I would say it really has been a wonderful experience. I learned a lot and enjoyed every single bit of it. My deepest thanks go to the head of the Editorial Team, Elena, for giving me this extraordinary opportunity along with all the guidance and assistance throughout the year; to my very talented team partner Kaichen for all the support, all the fellow editors and our designer Paul for their insightful suggestions. And of course, a big thanks to all our *CEB Focus* readers, who have made all the hard work very worthwhile.

See *CEB Focus* newsletter issues and editorial schedules on www.ceb.cam.ac.uk/news/ceb-focus

Reflections from leaving HoD Professor Nigel Slater

Professor Nigel Slater



Nigel Slater in the Bioscience Engineering lab

At the stroke of midnight on Wednesday 30 September 2015, I shall hand on the Head of Department baton to Professor John Dennis. Hopefully I shall do so having moved to the new building at West Cambridge with our removals complete and the Department ready to start a new academic year. But we all have our favourite “*difficult buildings*” story and CEB is no exception, so that goal is tantalisingly close but still remains to be realised. Wherever it happens though, I shall handover with a mixture of sadness and some relief since the past five years have been extremely rewarding yet quite testing.

Visible highlights have undoubtedly been maintaining the leading position in REF 2014 that my predecessor Lynn Gladden had set in RAE 2008, consolidating the operational integration of the Department of Chemical Engineering and the Institute of Biotechnology following the merger in 2008 and relocating us from three out-dated sites around Cambridge to an iconic new laboratory in West Cambridge. I want to put on record my immense gratitude

to my two Deputy Heads, Dr Patrick Barrie and Professor Lisa Hall. Patrick’s efficiency with the organisation of our teaching activities has been remarkable and he managed us very successfully through a probing Learning and Teaching Review. Lisa worked tirelessly and well beyond the call of duty to secure our outstanding success in REF 2014. I simply could not have had better or more dedicated support and it is to me no surprise that throughout, the Department has been ranked amongst the top 4 global departments in our discipline, and consistently the highest ranked outside the US.

But equally important has been the less visible highlights. It has been a great pleasure to work with our students. I have learned that CUCES is perpetually in dire financial difficulties and I have faced regular pleas to subsidise the Frank Morton Games expedition. It has been incredible to witness the many successes of our students in winning Salter’s Prizes, business competitions, conference prizes and various scholarships. We have grown our graduate study body through the immense success of our MPhil programmes in Bioscience Enterprise and Advanced Chemical Engineering and through a substantial increase in the numbers of research students. Indeed, growth is producing its own problems as we have already completely allocated every office and desk space in West Cambridge and have surreal discussions about the space each research student needs.

It has also been immensely rewarding to observe the development of our academic staff. I have been very fortunate to have been able to appoint a new Professor and several young Lecturers and this has brought new vitality into the department. *CEB Focus* has reported the numerous successes that our academics have achieved in a wide variety of activities; through promotion to Chairs and Readerships, through the award of Pilkington Teaching Prizes, professional titles and academic prizes and through their participation on prestigious governmental and professional bodies. My colleagues have won applause for their research work and have been awarded very substantial research income. It has indeed been an immense privilege to have observed these successes and I have derived much pleasure in seeing my colleagues’ careers blossom.

I am extremely grateful for the exceptional support of all our assistant staff, who have worked tirelessly behind the scenes to ensure the success of our operation. At the start of my term as HoD I introduced a termly “Departmental Forum” at which any member of staff can raise questions about departmental matters. This soon proved to be quite a gladiatorial event and, to my discomfort, I was often the poor guy being fed to the lions. But time and again these sessions revealed the deep commitment and pride of our assistant staff in the success of CEB, for which I am most grateful. Finally, Elena deserves a very special thanks for not only has she succeeded in keeping me organised but she has made such an outstanding success of *CEB Focus* since the first issue in 2010 and this has exceeded my most optimistic hope for the venture. So, I wish John every success in his new role and I am sure that he too will enjoy the support of all our staff and students.

CEB Women in Chemical Engineering and Biotechnology

Dr Claire Michel, Laser Analytics Group



Claire 'touching' the top of Mont Blanc, the highest mountain in the Alps

I was probably only a couple of years old when I first realised my Dad could not see. He could not catch the ball I was throwing to him, could not see my smile and would soon start asking regularly 'Claire, what does the sunset look like tonight?'. From a very early stage I just wanted to give him his eyesight back. It's therefore no surprise that, when at fourteen my science teacher first talked about genetics, I decided I wanted to become a researcher so that I could discover the mutation affecting my dad and two of his brothers. I told my dad about my aspirations and he went off to talk to some of his friends and came back a few days later with two different study routes: Medicine or the "Grandes Ecoles" in Biology.

I decided to take the latter route and stuck to it although it was hard. I was bullied as a teenager for being the top of the class. At that age it was much trendier to flirt with the opposite sex and smoke cannabis. I then promised myself that all those hours spent in the library would allow later on to find a job I loved. My undergrad studies were hard.

The French education system with the "Classes Préparatoires" and "Grandes Ecoles" was quite a tough route to take and many advised me to give up on my dream to become a researcher. The support of my family was crucial at that time. I'll always remember how my mum used to send me at least one postcard every week, telling me about all the little things happening at home with my three sisters, who I had left behind. I was missing them tremendously.

My dreams were fulfilled when I moved to Cambridge for my PhD studies and started spending my days in the lab, not working on blindness but on Alzheimer's disease. I have now been doing this for almost nine years, I have settled in this beautiful city, I have married a British man (another one of my silly childhood dreams!) and, all in all, I am happy. I am happy to get up every day to go to work, to see the results from the experiment I set up the day before, to spend time with students and colleagues troubleshooting our projects and to dedicate a bit of my time to improve the experience of Postdocs in this Department. And I am also delighted to spend some time redecorating my house at the weekends, doing some gardening or visiting some friends and family.

Do I consider myself successful? Yes. Maybe I am not the most successful woman by "Cambridge standards" but to my family, my friends, my husband and to myself, I am successful, simply because I consider myself very lucky to have a fulfilling life. Victor Hugo once wrote; '*Si Dieu avait voulu que l'homme reculât, il lui aurait mis un oeil derrière la tête. Regardons toujours du côté de l'aurore, de l'éclosion, de la naissance.*' (If God had wished man went backwards, he would have placed an eye on the back of his head. Let's always look towards the sunrise, development, birth.) This is my motto. I might sound like a grumpy woman sometimes and moan about many little or big things but I think I do it with the aim to bring improvement in everything I do. I like efficiency, results and commitment. I also want others to be happy too. This is what led me to create the Postdoc Committee in the Department, to create a forum where Postdocs could express their wishes and see how we could make them come true. And these wishes are not necessarily to become a Professor or to get a Nobel Prize. Many simply want some recognition. They want to work in good conditions and they want their involvement in their research group, in their Department and the University to be recognised.

Making people feel successful is often simply about appreciating the diversity of aspirations and acknowledging contributions at every level. This is what I try to do with my life, and to me, it is more important than being awarded any medal.

CEB New Building: Entering the Home straight ...

Dr Tom Matthams, CEB Academic Matters Administrator



As the evenings draw longer, the new building is getting ever closer. The external elevations are virtually complete, and work is continuing apace on the internal fit-out. Installation of the laboratory benches gives each room a sense of how it will finally look and feel once CEB researchers take up residence. In the office block, the signature atrium is taking shape with its oak windows and cladding and feature staircase rising all the way to the glass skylight that fills the tea-room with natural light.

From the outside, the CEB building is certainly striking- from the glass and zinc cladding of the laboratory block to the metal balustrades of the terraces surrounding the offices. In the spring sunshine, the building shimmers with light. As you move inside you get a feel of the scale of the building. The large corridors running around the laboratory block are fully glazed on one side, emphasising the huge space and providing researchers and staff with a light and airy environment in which to pursue their work. On the north wing, the enormous Magnetic Resonance Research Centre

(MRRC) facility takes your breath away - the double height space to house the Nuclear Magnetic Resonance machines is cathedral-like in scale, rising up over 9m and over 35m long.

Around the building, the Terahertz (THz) and Laser laboratories are almost complete, with their bespoke booms hanging over each optical table to house the array of instrumentation used in these groups. The undergraduate teaching laboratory on the ground floor, and the Materials Laboratories on the south wing of the first floor are also nearing completion. The biological laboratories on the top floor are a few weeks behind, but once these installations are complete, testing and commissioning of all the services will commence in earnest.

Over the past few months, excellent progress has been made with the internal fit-out, particularly to the laboratories, but it has not all been plain sailing. At the end of February, one of the main subcontractors went into administration, threatening the completion of the air handling systems, the CL3 suite and the supply of all the fume cupboards to the building. Fortunately, the main contractor Morgan Sindall has been able to secure alternative labour supply and ensure that the fume cupboards already manufactured were delivered to site, and the project timetable was relatively unscathed.

CEB is now aiming for a building handover for the end of July, with the move programme to take place during August and September. It will be a hectic time, but we aim to be up and running for the start of the new teaching term in October 2015 with a new building, a new head of Department, a top REF ranking, and a renewed enthusiasm to drive the Department forward for the next 50 years.

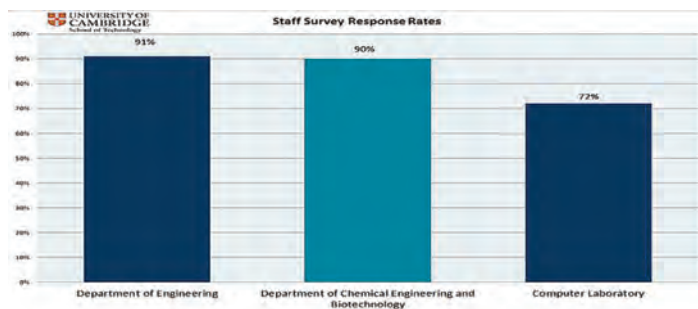


Staff Survey: CEB Family Have their Say

The staff survey is an extremely important opportunity for staff to share your views in light of the current restructuring of the Department different functions and the upcoming move to the new building.

During March, CEB undertook a staff survey alongside the Department of Engineering and the Computer Lab. A multi-faceted questionnaire was prepared by a working group chaired by Michael Barrett from the Judge Business School, Athena SWAN representatives from each department as well as members of the HR team bringing the committee up to 14 members, with Dr Krishnaa Mahbubani leading the preparations for CEB along with Professor Sabine Bahn.

The aim of the survey is to develop an understanding of employee views and opinions, identify areas for improvement within CEB, while helping maximise employee engagement. The survey considered ten aspects of day-to-day life in the Department from how staff members view their job, their personal and career development, opinions of leadership, management and communication within the Department, appreciation of existing work life balance, relevant pay grades and benefits available. It also considers attitudes towards fair treatment and the current perceptions of CEB at each level. It goes beyond job satisfaction and is not simply motivation.



Staff survey response rates by the three different Departments

of Department, Professor John Dennis, in the development of the direction and vision of the department over the next five years, and more imminently prioritising what actions need to be taken first and how individuals might contribute to the immediate work environment.

None of these can happen without the help of staff members willing to put in the time and effort for the improvement of the department as a whole. There will be calls for a working party to help interpret the outcomes of the survey, develop actions to tackle concerns and prioritise actions to be done. If you are interested in being part of the team, then please do not hesitate to get in touch with Dr Krishnaa Mahbubani (ktam2@cam.ac.uk).

CEB had a target of getting an 80% response rate and not only were we successful in reaching the target; we even surpassed it gaining an outstanding response rate of 92%. And that is thanks to all the members of staff who took the time to fill in the form and have their say. The outcomes of the survey will first and foremost be shared with all members of staff. The results will also assist the incoming Head

Cambridge University Wine Society (CUWS)

Richard Thorburn, Undergraduate Student at Downing College, CUWS Appreciator



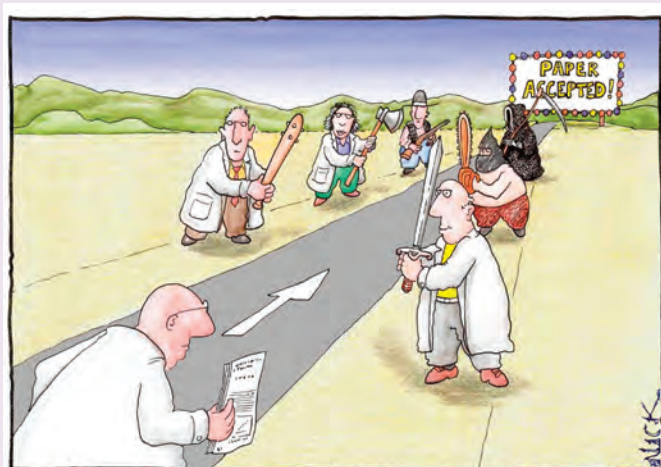
Nyetimber tasting (1992-2010) with wine maker Brad Greatrix on 4 February at Peterhouse Upper Hall

CUWS provides a great way to relax and enjoy your evening whilst learning about the world of wine. Whether you are new to wine or a true connoisseur, the evenings will teach you something new whilst you taste some of the best and most complex wines on offer around the world. The society hosts a wide range of high quality producers, from Nyetimber, the English sister of champagne, to Chateau Margaux, the most luxurious of French Bordeaux. The tastings are an exploration of each wine, and give an insight into the vineyard's methods alongside a description of each vintage. The society holds a dinner a few times a year, pairing wine with food and following the suggestions of those who are present throughout the year. Michaelmas term saw Bollinger

host a delicious dinner whilst in Lent term, CUWS hosted the decadent Chateau Climens and Chateau Brane-Cantenac at a four-course dinner. In Easter term, the society will host Meerlust and Roederer at a spring feast as well as a garden party on Saturday 20 June at Clare Scholar's Garden.

A wide variety of wines are shown and tasted throughout the year, from fruity Australians to rich Spanish reds. The events are frequently organised such that similar wines from contrasting regions can be compared so that one can understand the differences between regions. Although the wine selection usually includes particularly high quality wines, most tastings also present an opportunity to decide which of the more affordable wines on offer at local merchants are your favourite. CUWS is a fun and sociable society and despite the formal presentation of the evenings, the atmosphere and discussion is informal and welcoming. If you're interested in learning more about wine or simply want to try wines that you may not otherwise be able to, come along to a tasting! Also, more information can be found on www.srcf.ucam.org/cuws

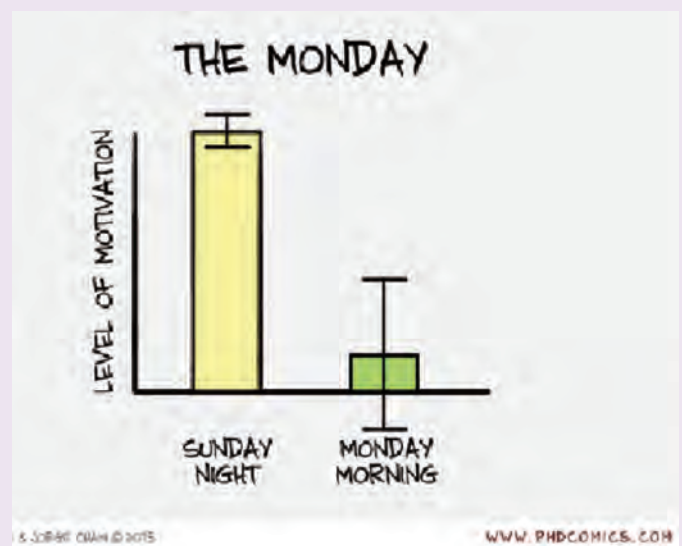
Peer-Review Process



Most scientists regarded the new streamlined peer-review process as "quite an improvement."

www.lab-initio.com

Monday Blues



Letters to the editor

We welcome comments from our readership. Please email us your views and suggestions for future articles on ceb-focus@ceb.cam.ac.uk

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