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CEB *Focus*

Department of Chemical Engineering and Biotechnology

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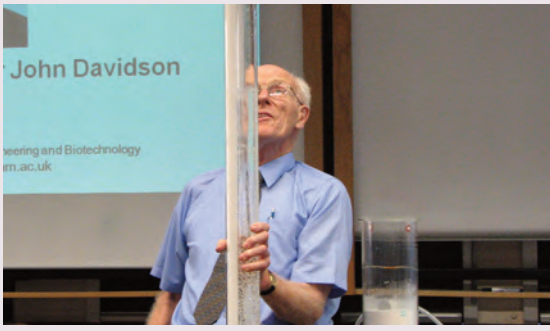


Emeritus Professor John Davidson: 63 Years in Chemical Engineering *p.22*

In this Issue

Welcome

Message from HoD, Professor John Dennis

During the last quarter of 2015, the emphasis in CEB has been on identifying and defining our mission and core values and key objectives for the Department. My core belief is that we have the quality of staff and students to be clearly No. 1 in the world, but that we have neglected some of the "people" issues as the Department has grown in size and breadth of activity. Accordingly, a critical aspect of my job over the last few months has been to stress that every member of CEB, be they academic or non-academic, has a critical role to play in achieving the Department's aspirations. As a result, our mission statement has a clear emphasis on commitment to the staff of the Department to ensure that we are able to offer attractive opportunities for work and study irrespective of gender and to demonstrate our commitment to equality and diversity. It is, of course, relatively easy to set objectives, but much harder, especially in academic life, to define a shared strategy and action plan to achieve them. The hard work to define such a strategy will begin in the New Year and will involve the newly-formed Strategic Management Board of CEB, drawing up draft proposals to be shared with all members of the Department, so as to take into account staff views. In many senses, the planning process is as important as the plan, and it is the ongoing process and consultation and refinement, which I trust will pay dividends. It will be an interesting year as shared plans mature!

Editorial Note

Chief Editor Elena Gonzalez (middle), Research students Noha Al-Otaibi and Aazraa Pankan (right), Geertje van Rees and new member Dimitrios Simatos (left)

The Editorial Team wishes all its readers a fantastic 2016! *CEB Focus* Newsletter is the product of a joint team effort led by Elena Gonzalez assisted by volunteer editors. We would like to welcome a new member to the Team, Dimitrios Simatos, a Sensor Innovation and Applications CDT 1st year graduate student. We are always keen to see new faces and if you are interested in joining, please email us on ceb-focus@ceb.cam.ac.uk. Each member is fully committed to the project and its timely delivery. Their individual contribution of enthusiastic ideas to the Team is also hugely valuable, helping further develop the quality of the editorial content and the publication look.

In this issue the *Front Cover* article focuses on the CEB Research annual highlight, The Research Open Day, where young researchers showcased the latest research projects of remarkable impact, helping others establish inter-disciplinary collaboration or making ground for new joint ventures.

Dr Graham Dransfield, CEB Knowledge Transfer Facilitator, offers an overview of the latest exciting industry collaborations and developments in *Industry Business*. *Undergraduate Focus* features recent graduate Jenny Parkin, Salter's Prize winner, and tells about preparations for the upcoming Frank Morton Games in Manchester in February.

Research Highlights features a selection of breakthrough, high-impact papers recently published by talented CEB researchers like "Towards a blood-based diagnostic Panel for Bipolar Disorder" by Professor Sabine Bahn and colleagues, whilst Research Feature tells of *ExoEvolution*, the Art-Science exhibition curated by CEB academic Dr Ljiljana Fruk.

In *Alumni Corner* Chemical Engineering graduate Gavin Patterson, Chief Executive Officer BT Group, highlights the benefits of his Chemical Engineering Degree.

People Focus presents Emeritus Professor John Davidson, in advance of his 90th birthday, who shares his memories of 63 years in the Department, his involvement in the Court of Enquiry Report following the 1974 explosion at the Flixborough plant including important health and safety lessons learned. CEB would like to thank him for his hugely valuable contribution to the Department and the Chemical Engineering discipline.

Finally, *Staff Room* tells of important service milestones reached by assistant staff, birthdays and colleagues gone in search of pastures new: happy retirement to both John Gannon in Electronics, Lyn Hurst in Accounts and Professor Howard Chase. Best of good luck to all in their new ventures!

CEB Focus would like to thank webmaster Vanessa Blake for regularly providing photos, and department members, alumni and corporate partners for sending article contributions.

High-Impact Research CEB Annual Showcase

Elena Gonzalez, Chief Editor

Opening proceedings at Robinson College Auditorium

CEB hosted its annual Research Open Day (RoD) on 12 January 2016 at Robinson College in Cambridge. The annual flagship event brought together the Department's research groups through a series of talks and research project poster presentations covering a wide spectrum of on-going research activities across different areas and cross-cutting technologies. With over 150 people in attendance this year, the event proved to be a fruitful day of industry-academia engagement once again. At this year's RoD, attendees were at hand to facilitate conversations with corporate partners and representatives from key Chemical Engineering and Biotechnology industries: including young researchers and Principal Investigators, CEB's Knowledge Transfer Facilitator, colleagues from the University's Research Communications Office and Cambridge Enterprise. They all congregated to celebrate the Department's research diversity showing the richness of research projects in the Department but also offering great potential for collaboration among different research groups in the Department and collaboration with local and global chemical engineering and biotechnology companies.

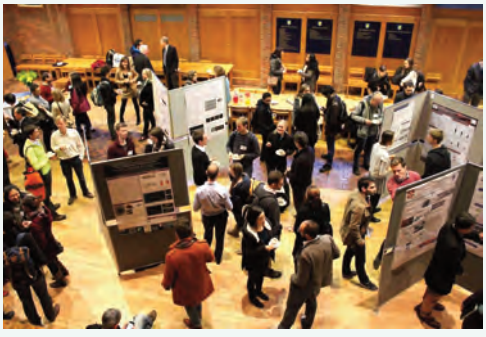
The event programme included extremely inspiring and interesting talks focused on strategic research themes with a great varied selection of research topics under discussion. There was very lively interaction amongst researchers from different groups.

Professor John Dennis (Head of Department) kicked off the event with an opening welcome in the Auditorium highlighting CEB's achievements since the merger of the Department of Chemical Engineering and the Institute of Biotechnology back in 2008 to culminate in the move to the new building in the West Cambridge site later on in this summer. He commented; *'The Research Open Day is a very important activity in presenting the very best of our research and, in particular, demonstrating its impact on industry, on healthcare and on society in general. It is also noteworthy that it is organised by our talented cohort of post-doctoral researchers, and it is their talent, enthusiasm and commitment to CEB and to their research which brings a distinctive freshness and liveliness to the proceedings. It is an important occasion for CEB'.*

Around 15 corporate representatives and partners, old and new, attended the Research Open Day. Throughout the day, young scientists from CEB research clusters of Reaction Engineering, Microstructure Engineering and Biotechnology discussed their most stimulating research activities with leaders of industry. The projects undertaken covered areas as diverse as Materials and Processes, Healthcare, and Modelling and Metrology.

Following attendance last year, John Faraday from Sulnox has now invested in a Post-Doctoral Research Associate (PDRA). Josh Etkind from Shell was converted to the cause of MOFs, which he strongly champions within the company, and Shell has since sponsored a PDRA and a PhD student within Dr David Fairen research group.

CEB Focus caught up with several captains of industry such as Paul Varley from MedImmune, Michael Butler from Unilever, Leslie Bolton from BP, Andrew Smith from Johnson Matthey, Adriana Botes from Invista, etc...



Young researchers' poster presentation

Biotechnology alumnus Dr Darrin Disley, a serial entrepreneur, top innovator and Horizon Discovery CEO, was also among those present. Whilst at the research poster presentation Dr Disley showed great interest in the eScent® contextual technology in the wearable personalised medicine field developed by Dr Jenny Tillotson, CEB visitor working with Professor Chris Lowe (see *CEB innovation* article on Page 13).

Dr Claire Michel and Dr Krishnaa Mahbubani at the front with other event committee members

There were also a series of talks on offer and flash posters from young researchers on show. Tamsin Bell from the Catalysis group presented a poster on Hydrothermal synthesis of nanostructured g-Al2O3 with controlled size and morphology in a recyclable process. She commented on the event; *'As a new PhD student, CEB Research Day was a great opportunity to learn about the diverse research activities taking place at CEB and to meet some members of the Department. The invitation to present a short presentation about my research poster was really valuable in encouraging participants to talk to me during the poster sessions. I was impressed with the organisation of the event and the engaging talks given by the speakers.'*

Dr Krishnaa Mahbubani, Chair of the Organising Committee, mentioned; *"After the success of the Research Open Day last year, I'm glad Post-docs of CEB (PCB) had the opportunity to run this event again. There's so much new and exciting research happening within the Department that it's so important we come together and show-off all we have to offer".*

Potential areas for collaboration in the area of Bioengineering have reportedly been identified following the sharing of ideas and discussions throughout the day. In addition, enthusiastic participant Lindsay Chapman from the National Physical Laboratory, based in the new Maxwell Centre in West Cambridge 2 days a week, showed willingness to work closely with the University. She is interested in any science, where measurement standards are required, and came away from the day with a number of ideas for potential collaboration. She will also be attending the 'Institute of Biotechnology (IoB) welcomes new PIs' event on 19 February.

The annual event offered a fantastic opportunity for group leaders, post-doctoral researchers and PhD students to share ideas, explore opportunities for cross-disciplinary collaboration and forge new and innovative links with industry. Dr Claire Michel, member of PCB and one of the organisers of the event, added; *'I would like to thank all the speakers who, through their talks, contributed to make the success of the day.'*

Dr Dransfield added; *'Given the commitment required to devote a day to such an activity, this is a great result achieved by PCB and a sharp increase on last year's inaugural event. It is also gratifying to note the range of interests of the companies: from healthcare to petrochemicals. Giants such as Unilever are represented, as well as start-up companies such as* SulNOx (fuel emulsions) and Woolcool (natural insulation solutions). *I am sure that their presence will stimulate further lively discussions into potential applications of the excellent science being generated within CEB.'*

The event offered young researchers an opportunity to discuss their projects with delegates, network and make valuable connections whilst exploring the potential for new valuable partnerships. The day was rounded off with a plenary talk by Michelle Oyen, a Reader in Bioengineering in the Mechanics and Materials Division and the Bioengineering research group in the Engineering Department.

A drinks reception for all delegates then followed to round off the day when they were able to discuss and unwind with their academic peers, discuss potential collaborations and develop new ideas. The PCB Committee looks forward to organising the next research showcase in 2017 and help further bridge the academia-industry gap.

Industry and academia networking session

A Message from CUCES (Cambridge University Chemical Engineering Society)

Rachel Oldham, CUCES President 2015/16

As a new year is beginning, CUCES hope that you all had a fantastic break and are ready for this term. We had a very busy Michaelmas term filled with careers events, welcoming the new Part I students and lots of social activities to keep us busy! As a committee we look forward to our last term in office bringing the undergraduate community together and, for some of us, making the most of our last few months in the Cambridge bubble.

As you've all probably realised, membership to CUCES is free and automatic for all members of the department. CUCES wouldn't be able to function in this way and put on all these great events for you without the help of sponsorship from various companies. We put a lot of time and effort into finding this for you all and they spend a lot of money on us, hoping to secure the bright and best students for their companies in the future. So now, we'd like to say a big thank you to BP for sponsoring Christmas Dinner and the awards given out to Part IIA students this year, ExxonMobil for sponsoring the Part I quiz and to Johnson Matthey and P&G for providing the money so we can feed you at their careers talks. We are looking forward to working with new sponsors for our upcoming events, such as Frank Morton and Annual Dinner this term.

We hope you all have a fun, productive and stress free term, and look forward to seeing you at our events and around the department.

Christmas Dinner sponsored by BP

Vidur Mehta, CUCES Social Secretary 2015/16

On Thursday, the 26 November 2015, CUCES held their annual dinner at Browns, a restaurant and dining venue on Trumpington Street. Over 100 undergraduates from all three years attended, along with two representatives from our sponsor BP, numerous researchers, lecturers, MPhil students, and PhD candidates.The CUCES committee scurried around inside the restaurant from 6pm, laying out customised menus, tagging wine bottles, and ensuring that everything was running smoothly. Attendees began arriving at 7pm for the 7:30pm start, eager for the scrumptious food and entertaining company that awaited them. The homemade reindeer table centre pieces were a hit with everyone - CUCES going the extra mile to make the evening as special as possible. By the time the starters were served, conversation and laughter were flowing freely, everyone grateful for an evening of relaxation and fun with friends old and new. . All of our guests had a fantastic evening of great food and great company. This was all made possible by our sponsors, BP, to whom we would like to give our thanks. We hope you all enjoyed your evening as much as we did.

Frank Morton Games Return

Michael Ryan, CUCES Secretary 2015/16

IChemE FRANK MORTON MANCHESTER 2016

After the success of last year's Frank Morton in Birmingham, Cambridge is returning to the nation-wide sports day and is hoping to do better than ever! Since its inception in 1961 the Frank Morton Sports Day has seen explosive growth, going from 2 to over 30 Chemical Engineering departments this year. The first event was organised by Manchester professor Frank Morton, whose love of sports led him to organise a football match with his previous university, Birmingham.

This year the event will be held on 16 February in Manchester, bringing together around 3000 Chemical Engineers to compete in over 25 activities. Ranging from football and track events to Quidditch and ultimate Frisbee, Frank Morton certainly encourages some of the more whacky sports, often combined with questionable levels of drinking. This year will see the addition of activities including chess and pool, so no matter where your skills lie, you'll certainly be able to help us win those medals!

After an early start to get to Manchester, the day will kick off with a carers fair in the "famous" Manchester Central Convention Complex (which will be the base for the day). The sports will start soon after, finishing around lunchtime. This leaves the rest of the day for enjoying the fine establishments of Manchester, before returning for the closing ceremony and all important results! Last year Cambridge came joint 9th, but this year we can do even better! Once the champion has been crowned the teams will scatter across the bars of Manchester before heading back to the University of Manchester Students' Union for "a night of live bands, DJs and artists from across the country performing over 5 stages". Whatever happens, it's certainly going to be a memorable day!

IChemE Competiton Winners

Fan Ray Aun, CUCES Careers Rep 2015/16

In summer 2015, the Institution of Chemical Engineers (IChemE) launched a competition for undergraduate students to design a chemical-engineering-themed video for school children aged 16 – 18 . The videos were judged based on the breadth of information, level of detail, presentation style and accuracy of contents. Ray and Khoon Kheng (KK) from our department emerged as the winners of the competition. They hoped to provide students with an insight into the fundamentals of chemical engineering and their application in process design. The video focused on 5 key design considerations which include material selection, process control, production optimisation, product extraction and waste management. The Haber process and bread making were used as examples to explain important concepts such as catalysis, separation and filtration in an effective and comprehensive manner. The video is currently featured on the IChemE website for students' reference alongside with other insightful videos by IChemE at www.whynotchemeng.com/information/videos. As a reward for the competition,the two of them have won entry to an IChemE training event to gain more experience in the discipline. With the increasing world demand for energy, food and other necessities, more chemical engineers are needed to ensure these demand are met with safe and environmentally-friendly industrial processes. Ray and KK also encourage more chemical engineers to get involved in educational initiatives to promote the discipline as well as to inspire young future industry leaders.

Salters' Graduate Prize

Colonel David Woood, Jennifer Parkin and Professor Sir John Holman

Jenny Parkin, a recent graduate from the Department has been awarded with the Salters' graduate prize. The Salters' Prizes are awarded annually in recognition of academic achievement as well as potential ability to make a significant contribution to the development of the UK chemical industry.

Founded in 1918 by the The Salters' Company, the Salters' Institute of Industrial Chemistry plays a major role in the support of chemistry teaching, the encouragement of young people to pursue careers in the UK chemical industries and the promotion of chemical education including the whole area of curriculum development. Up to ten Salters Graduate prizes, of £1,000 each, are awarded to final-year undergraduates studying at UK universities, trying to keep an even balance between chemists and chemical engineers.

Congratulations to Jenny for this fantastic achievement. We look forward to hearing about more of your successes in the future.

More info on www.saltersinstitute.co.uk/history/

Mexico Rocks at ACE Course

Cambridge is a truly multicultural city and CEB is a prime example. On this issue we feature three Mexican students in the MPhil Advanced Chemical Engineering (ACE) course. The world is an oyster but a truly small one indeed: the Department has brought Andrea, Miguel and Eduardo together in their new home away from their home in Mexico even though they had never met before. Known as the "Mexican team" at CEB these guys are delighted to share their new experience with the Editorial Team:

Being a member of CEB's MPhil ACE program has been enriching experience, both culturally and academically. For us, it has been a unique opportunity learning from the Professors within this Department and being challenged by the lectures in which we are enrolled in. But it has also been very fulfilling getting to know amazing people from different backgrounds and nationalities with whom we have things in common, such as our passion to learn and to challenge ourselves, which are some of the reasons that brought us here. Besides working hard, we have managed to find time to enjoy the social life at Cambridge such as; attending formals, going to some Colleges' pops, or just chilling out with our new friends. We are more than happy to be part of our beloved alma mater in Mexico 'Universidad Nacional Autonoma de Mexico' (UNAM) and the one that the University of Cambridge will become.

We are looking for the future challenges that await us, we hope that somehow we are able to leave some of our Mexican spirit within CEB.

Left to right: Andrea Gayón Lombardo, Miguel González Morales, Eduardo Nolasco Rosario

Sensors CDT Champions

Josie Hughes and Philip Mair

The EPSRC Centre for Doctoral Training in Sensor Technologies and Applications (CDT) recruits students with backgrounds in engineering, natural sciences, medicine and computer science. The transition from a single disciplined undergraduate to a multi-disciplined researcher poses a steep learning curve. The students find themselves study unfamiliar topics, they need to deliver projects fall outside their comfort zone and have to work in diverse teams. Two students in the first cohort of the Sensor CDT stood up to this challenge. Josie Hughes, who received an engineering degree from Cambridge, shared her electronics and programming knowledge with the rest of the cohort, helping biologists and others to make sense of data acquisition and data handling. Philip Mair has a biology degree from ETH Zurich and subsequently spent one year as a Master student in the Department of Biochemistry in Cambridge. He is used to handling small and delicate samples - a skill which he used to solder tiny surface mount electronics components. He also didn't shy away from learning new programming skills and implemented a machine learning algorithm into a fall sensor, helping it to reduce false alarms. He also took on the role as team leader in the Sensor Team Challenge where all ten students had to work together for three months. Throughout the course both students rose to the challenge of attending lectures from a number of new disciplines and achieving 1st class marks in their exams.

Shell funds CEB Grad

Dr Shafiq Ahmed, Energy Initiative Co-ordinator

Andy Brown, with Shell-funded Cambridge PhD students and CEB PhD student Isabelle Bush (second from the right)

On 29 October Andy Brown, Director Upstream International from Shell, with a delegation visited the University of Cambridge. Shell met with Shell funded PhD students who presented their research in five minutes. The session was chaired by Dr Dan Credgington, and Energy@Cambridge Energy Champion in the Department of Physics. The talks covered topics including Active Coastal Tectonics in the Mediterranean, Self -Healing Cement and NMR Studies of Enhanced Oil Recovery.

Professor Lynn Gladden, Pro-Vice Chancellor for Research, welcomed Andy Brown and Dr Enass Abo-Hamed, an Energy Champion in the Department of Chemistry, introduced Andy Brown who presented a lecture entitled 'Challenges and Opportunities in the Future of Energy' to an audience of around 150 students, academics and Shell representatives. Andy spoke about the company as a pioneer which has a history of new technological developments, including the first floating natural gas facility and the largest gas to liquid plant in the world.

According to Shell's global energy outlook, by 2050 there will be around 9 billion people, and over 2 billion vehicles. The energy demand will be double the amount required in 2000 and with three times the amount of renewable energy.

Andy summarised that the transition to a low carbon economy requires energy efficiency, carbon capture and storage, future fuel as a clean energy carrier, more natural gas and effective carbon pricing. Following a lively discussion after the talk, the evening ended with a networking drinks reception.

See more information about Energy@Cambridge initiative on www.energy.cam.ac.uk/aboutus/aboutenergyatcambridge

University Careers Service: Exploring your Options

The Careers Service, located at 6 Mill Lane

The University has its own Careers Service, which offers a wide range of services from exploring your future options to bursaries to job offers. Essentially, they are able to help with a job application process from start to finish, from exploring to searching the right vacancies, to applying and successfully going through the selection process. The main services include:

- Explore future potential directions
- Jobs and work experience; ranging from guidance, holiday work, job search to entrepreneurship
- Training and help with applications and job interviews.

Alongside these services, they have essential guides in the main library, whilst the majority of career guides and sector-based 'takeaways' are in the lower library. Takeaways can even be found in the hallway when you enter and, most importantly, all are free. Next to this, the Careers Service has written two books – 'CVs and Cover Letters' and 'CVs and Cover Letters for PhDs and Postdocs'. These books aim to help meet the needs of Cambridge students, graduates and postdocs as they write their own CVs, from first steps to final polish. Both books are free to Cambridge students, graduates and postdocs as well.

When exploring different job options, GradLink could be worth considering, their database of alumni who are willing to be contacted. This allows for the opportunity to ask them about their job roles, employers and experiences.

As well as the amount of information the Careers Service is able to offer, they have a term diary of events offering sessions on practicing interviews, skills workshops, introductions into different work fields and talks from different leading companies. The selection of courses available for this term can be seen on www.careers.cam.ac.uk/notice/diary.asp

New Options for Part 2Bs

Pharmaceutical Engineering

Picture from GEA pharma section, demonstrating a production on demand (POD) mini-factory. www.tinyurl.com/o6by69c

Pharmaceutical Engineering will be offered this year as a new option in Part IIB of the Chemical Engineering Tripos. The course will provide an overview of the pharmaceutical development process and teach the fundamentals of engineering principles required in secondary pharmaceutical progressing.

In recent years there has been a significant advance in improving the quality of pharmaceutical manufacturing by removing regulatory hurdles and improving process understanding. Apart from a few notable exceptions, pharmaceutical manufacturing has been dominated for a long time by empirical batch processes, which commonly require costly scale-up operations from the lab scale via the pilot scale to full production scale. The recent change in regulation allows for much greater freedom in process control, as long as the manufacturer can demonstrate sufficient process understanding. This "quality-by-design" initiative is being implemented in industry right now and the course tries to provide an overview of recent developments in this area.

In addition, there is a push in the industry towards continuous production at smaller scale to avoid scale up operations altogether and steer clear of lengthy cleaning cycles that are currently needed between processing large batches of different products on the same equipment. Continuous processing in pharmaceutical solid state dosage form production will be another focus of the course and the course will try to highlight the unique challenges and opportunities that are associated with this development.

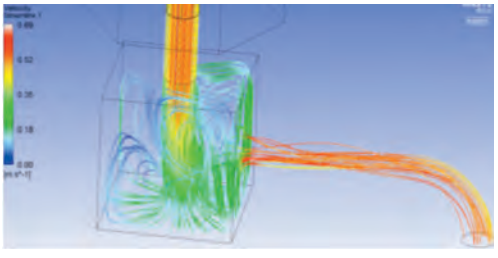
Computational Fluid Dynamics

This course was offered for the first time last year. It introduces a branch of fluid mechanics known as Computational fluid dynamics (CFD): a branch of fluid mechanics that uses numerical methods and algorithms to analyze and solve problems that involve fluid flows. CFD involves the definition of suitable boundary conditions, followed by millions of iterative calculations, performed by computer(s). CFD models are increasingly used in design optimization – once a model is validated against experimental data, it can be used to optimize a physical system more effectively than modifying and re-testing a succession of prototypes.

The course is structured around ANSYS CFX, a leading commercial CFD software platform. An introductory series of lectures covering the background and theoretical basis of CFD is followed by a series of tutorials and an assessed assignment that involves:

- Generation of a 3D CAD representation of a simple fluid system involving solid boundaries
- Creation of a suitable 3D mesh, for use in the subsequent finite volume analysis
- Definition of physical properties and boundary conditions
- Configuration of an FEA solver to achieve efficient convergence to the predicted solution
- Assessment of the model predictions, with regard to mesh-independence and accuracy

Dr Mark Williamson, who developed and runs the course, says: *"In its first year this new course was chosen by nearly half of the IIB class. Early indications are that it will be popular again this year. The focus is very much on the practical application of this tool, and, in particular on the development of an understanding of its capabilities and limitations. With this in mind, we use real industrial problems as the basis for our assessed assignments".*



An example of a CFD, illustrating the fluid flows

Blood Test to detect Bipolar Disorder

Source: www.bbc.co.uk/news/health-32530339

Leading CEB biotechnology researchers have recently had their breakthrough paper *"Towards a blood-based diagnostic Panel for Bipolar Disorder"*[1] published by Elsevier. Professor Sabine Bahn (Head of the Cambridge Centre for Neuropsychiatric Research group), Dr Jason Cooper and Frieder Haenisch have all contributed to the study as authors to this paper.

Bipolar Disorder (BD) is a costly, devastating and life shortening mental disorder that is often misdiagnosed, especially on initial presentation. Misdiagnosis frequently results in ineffective treatment. We investigated the utility of a biomarker panel as a diagnostic test for BD.

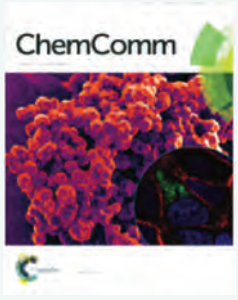
The study demonstrates the potential utility of a biomarker panel as a diagnostic test for BD. Following the paper publication, Professor Sabine Bahn, added; *"Unfortunately 40% of patients with bipolar disorder are initially misdiagnosed and thus it takes on average 7-10 years until a correct diagnosis is established. This has detrimental consequences for the patient as well as society and the healthcare system. Our study provides encouraging initial results that a blood test could help to diagnose bipolar disorder early on in the disease course. The results require further validation in prospective clinical trials."*

[1] *Haenisch F, Cooper JD, Reif A, Kittel-Schneider S, Steiner J, Leweke FM, Rothermundt M, van Beveren NJ, Crespo-Facorro B, Niebuhr DW, Cowan DN, Weber NS, Yolken RH, Penninx BW, Bahn S.*

Fluorescent Shell Localisation in Therapeutic Bacteria Spores

CEB research has been presented on the front cover of the 17 November 2015 Biophysical Journal. Dr Eric Rees and Dr Graham Christie, have presented an analytical method to measure the structure of protein layers in bacterial spore coats. This will assist in a joint project with MedImmune on the use of live edible bacteria for drug delivery. They have pioneered a method of Ellipsoid Localisation Microscopy (ELM), which is able to measure protein layer separation. This method has wide applications and is the first example of a set of Fluorescent Shell Localisation methods being developed at CEB. It will be used to optimise the structure of bacteria strains being developed for therapeutic drug delivery in the future. Nonlinear optimisation techniques, also a key interest at CEB, may also be developed to speed up the image analysis.

MOFs in 'ChemComm'



The Royal Society of Chemistry "ChemComm" magazine front cover has recently featured CEB academic Dr Fairen's breakthrough paper *"amorphous metal-organic frameworks (MOFs) for drug delivery"*[2]. Cancer is the most common cause of death after cardiovascular diseases. Finding an effective drug delivery system (DDS) for therapeutic agents has been an ongoing challenge in bioengineering in order to improve the efficiency of therapeutic agents. Dr Fairen's MOFs have emerged as potential candidates owing to their distinctive characteristics, such as high pore volumes, large surface areas, and tuneable surface chemistry. The relatively poor chemical stability of the MOF family compromises many of their advantages for industrial applications. However, in drug delivery processes this chemical instability can be considered advantageous, since, unlike e.g. mesoporous silicas, MOF-DDS can be degraded in the body after the drug has been released. However, limitations in their use do still remain such as very fast kinetic deliveries of under 3 days.

Recent work by Claudia Orellana-Tavra at the Adsorption & Advanced Materials Lab led by Dr Fairen-Jimenez, in collaboration with the Functional Inorganics and Hybrid Materials from the Department of Material Science and Metallurgic, has achieved an extended release over more than 30 days, compared with only the 2 days from the original MOF. The DDS was not only able to extend the release time but to penetrate into the cells while maintaining the kinetic characteristics of the delivery. The article in question published in Chemical Communications. See article abstract on www.pubs.rsc.org/en/Content/ArticleLanding/2015/CC/C5CC05237H#!divAbstract

[2] *Claudia Orellana-Tavra, Emma F. Baxter, Tian Tian, Thomas D. Bennett, Nigel K. H. Slater, Anthony K. Cheetham and David Fairen-Jimenez*

FGFR-1 Protein Kinase: 'Elusive' Target in Cancer Research

Dr Jonathan J. Phillips' paper *"Structural and dynamic insights into the energetics of activation loop rearrangement in FGFR1 kinase"* has been published in Nature Communications Journal. Protein kinases are considered to be the second most important group of drug targets (after G-protein-coupled receptors).

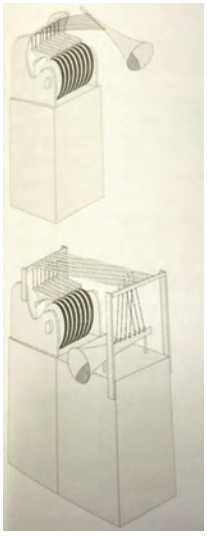
Recent work by Dr Phillips, in collaboration with MedImmune and AstraZeneca, has focused on the Fibroblast Growth Factor Receptor 1 (FGFR-1) kinase domain. This has yielded major insights into the structural dynamics of these kinases. This protein is heavily implicated in the development of blood vessels in a number of tumour types, including breast, pancreatic, prostate and ovarian cancers. As such, it is a valuable target in cancer research - however, it is highly resistant to adopting the druggable 'DFG-out' posture (form of the protein that must be targeted to design a useful medicine). This study dissects how the natural, unstimulated activity of the protein is linked to its molecular dynamics in detail resolved at high spatial resolution. This provides a rationale for why FGFR-1 kinase so rarely adopts a druggable state and has proved to be one of the most elusive of high-profile targets in cancer research. Read the paper on www.nature.com/ncomms/2015/150723/ncomms8877/full/ncomms8877.html

Artistic Science or is there anything behind the Art/Science Hype?

Dr Ljiljana Fruk, CEB Lecturer

On a scale of eccentric, Joe Davis would come pretty high. He is an artist, but also an excellent molecular biologist although without the formal science degree and could be found running experiments in George Church's Harvard group. Joe's dad was a chemist so he was exposed to science from the early age, but his curiosity is something that transcends the confines of often artificially postulated fields.

Both art and science, like many things in the anthropocene age, can be dominated by large personalities who try to preserve their unique position by creating two separate worlds, small realms of mutually exclusive realities. Except that they are not. The whole confusion started sometime in the early 19th century with Auguste Comte's scale of knowledge value. He proposed the knowledge ranking, and in his opinion the knowledge is more positive and reliable (and valuable), the greater its quantifiability and mathematisation. Although, art and science might differ in the approach and the final goal, they have one important thing in common: creativity. There have always been examples of artists doing science, and numerous examples of scientist who have been excellent painters or musicians. Among many, Alexandar Borodin, who is known for his work on aldehydes and was professor of chemistry (even establishing the first medical courses for women in 19th century) and had an extremely successful second career as a composer (Prince Igor) and was a member of the Russian Five. Or Santiago Ramon y Cajal, a brain researcher and the Nobel Prize winner, whose neuron drawings, full of poetry and undeniable artistic beauty, are still used in modern textbooks. Many interesting examples of the art and science interaction have been described in our book Molecular Aesthetics (MIT Press 2013) and some are shown at the exhibition currently on in Karlsruhe, Germany. One of the modules within this first of its kind, art-science Exo Evolution exhibition (ZKM, Karlsuhe, on till March



The Instrument that Plays by Itself (Banu Musa, ca year 850). Illustrated by Liang Zhipeng, ExoEvolution 2015

2016) is called Alah's Automata. These exhibited automata, created between 9th and 13th century, represent a small selection of machines stemming from the first Renaissance, arising on the Arabian Penisula, in North Africa and south-western Europe. Automata or self-automated devices are artistically exquisite pieces, often designed by engineers and based on extensive knowledge of mechanics, kinetics, hydraulics and pneumatics. The designs were marvels of engineering and science extensively documented in numerous manuscripts such as Banu Musa ibn Shakir's *Book of Ingenious Devices,* which documents a very modern world: programmable motion sequences, controllable properties of materials for movement induction and intricate philosophical ideas. One of his designs was a music automaton, which records and plays different voices (The Instrument which Plays by Itself, ca. 850). Fascinating world of automata is not only full of engineering marvel but also a very unique artistic experience. For example, The Elephant Clock of al-Jazari (year 1206) is probably the most beautiful example of early globalisation with different parts and decorations stemming from various parts of the world (Persia, Alexandria, India, Mesopotamia, China and Greece).

Art is all about the communication, connecting unexpected and impossible, of peace and tolerance, and such was also the First Renessaince, often forgotten in the light of more famous and much younger, European one. Artists create new realities, their imagination can run wild and they have a licence to experiment and push the boundaries. Scientists are not unlike artists, they just add the analytical approach to the exploration and open up the routes to new knowledge. There is a term coined by philosophers and art historians to describe the new era of contemporary art: Rainassaince 2.0: a scientification of art. In fact, Hockney-Falco thesis (postulated by an artist and a physicist) states that advances in realism and accuracy since the Renaissance were primarily the result of advancement of optical instruments, rather that the result of development of artistic technique and skill. Over the past centuries scientist and engineers have created a number of new tools, new materials to work with, new data processing machines, which are no longer confined to the specialised labs or preserved in a certain elite circles, but available to many. Artist have started to embrace the new possibilities to express themselves and address global societal issues such as environmental and infosphere pollution (i.e Pinar Yoldas, *Ecosystem of Excess,* 2014: Yesenia Tibault–Picazo, *Craft in the Anthropocene* or Chris Jordan, *Midway: Message from the Gyre,* all featured in ExoEvolution). Often artistic installations on the verge of science and art are not only aesthetically pleasing or provoking, but can have a high problem solving value such as *The Dinkable Book* by Tehreasa Dankovic, a book written with the water purifying ink.

One particularly exciting tool, emerging after the rapid advancement of molecular biology, which fascinates artists are all things biological: DNA, microorganisms, proteins, tissue. Joe himself has been encoding information in bacterial DNA, has manipulated the silk proteins to bind gold and is planning to write part so the Bible into the genome of original apple (and if you think now: yeah, but why?, have a look at the latest issue of Trends in Biotechnology; his work is featured on the cover page, see below). He made bacterial radio and fishing rod that fishes microorganisms. In the words of George Church, having him in lab brings particular level of out-of-the-box thinking. Having met Joe on several occasions, I can definitely confirm that.

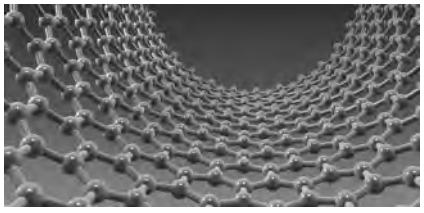
There are many examples of bio-artists featured in ExoEvolution, which illustrates the scientific progress that is globally embedded in our daily life. For example, Maja Smrekar in her installation *Hu.M.C.C.-Human Molecular Colonisation Capacity* (2012) uses her own enzymes to produce yogurt offered to visitors to taste. In such way, she is drawing attention to the food production and engineering in the face of rapid population growth. Koen Vanmechelen, *La*

Biomista - Cosmopolitan Chicken Project (2015), is trying to design a disease resistant chicken by breeding chickens from all over the world. I also stepped out of my scientific box to design the installation called *Quintessence* (2015) focusing on DNA synthesis and implication our knowledge and research on DNA and genetics has on the wider global scale, and *Seeing the Invisible* (2015), to encourage the exploration of all things nano.

I see artists as boundary shifters and have hosted some of them in my lab, the latest being Martin Kaulen, a young Chilean artists exploring the symmetry and crystals by, for example, looking for similarities between pieces of oriental architecture and quasi crystals.

Next year I will hopefully be able to help a group of artists aiming at writing a message of peace into *Pseudomonas syringae* and use it to make clouds in a symbolic attempt to employ natural clouds, as opposed to the Cloud, as information carriers.

When people ask me what do I get besides the aesthetic appeal and creative input (which in itself is a lot already), I usually tell them: a bit more playfulness and a little nudge in the direction I might not have taken by myself. How wonderful it is that we live in the age of interdisciplinarity and we are encouraged to cross the boundaries. Creativity is fluid that flows best when not confined by preconceptions and non-malleable rules. It is so great to see that art and science have found the way back to each other and academic institutions are embracing the trend. The trend it might be, but it is the most natural way to work and create so, finally, this trend is spot on!



Li. Fruk, B. Lintermann, R. Mach, grid structure of grapheme from ***Seeing the Invisible,*** *2015*

Further reading for the curious minds:

Molecular Aesthetics by Ljiljana Fruk and Peter Weibel, MIT Press 2013.
Robert Root Bernstein, Aesthetics, Media, Sciences, and Technologies: And Integral Tetrahedron and other articles by Robert
Joe Davis, Trends in Biotechnology, December 2015 issue.

eScent® wins Contextual Technology Award

Dr Jenny Tillotson, CEB Visiting Scholar

Dr Jenny Tillotson receiving her award

Dr Jenny Tillotson, CEB visiting scholar, Winston Churchill Fellow and a collaborator with Professor Chris Lowe in the Healthcare Biotechnology group at the Institute of Biotechnology, have won the *'Most Innovative Contextual Technology 2015'* for eScent® and innovations in sensing and dispensing fragrances for digital health, wellbeing and fashion applications at the Tech Expo Awards in London. eScent® was also highly commended in the *'Rising Tech Star 2015'* category.

Tillotson is the inventor of eScent®, a highly scalable platform technology that emits micro-doses of mood-enhancing aromas at the right time, in the right place, depending on context. eScent® dispenses well- being fragrances from a wearable device with connected sensors that mitigates and relieves in response to detected conditions, such as insomnia, stress or anxiety disorders. It is an example of the emerging *"Internet of Me"* for its ability to detect and analyse conditions that our five senses cannot and in turn deliver lifestyle and wellness enhancing results to us.

eScent® concentrates on the *personal sensory space* around the user; it merges clinical aromatherapy with

sensors to create data- driven solutions for well-being and preventative healthcare, informed by recent psychology, neurology and chemosensory evidence-based studies that show the benefits of aromatherapy[1] and the influence of certain fragrances on affective as well as cognitive states in humans.[2]

Embedded discreetly in jewelry and clothing (such as a button or the collar of a garment), eScent® forms a localised *'scent bubble'* around the face; an area of constant, detectable scent for the user based on a timer, biometric feedback, sound or pre- programmed from a smartphone. In response to real- time dynamic changes in behaviour, mood, voice analysis and biology (via HRV, sweat, stress- related body odour or skin response), eScent® dispenses fragrances in short bursts that are relevant to the situation, health condition or context of location, augmenting how we as humans interact with the physical world around us. For example, this could be the release of counteractive well- being scents when a pre-set stress threshold is exceeded or calming scents when a change in sleep is detected, or insect repellent is dispensed in response to the sound of mosquitoes.

Tillotson's involvement over the past year has been in digital solutions for chronic mental health with a particular focus on leveraging disparate data sources to discover more accurate health- related correlations. She reached the final of the 2015 Digital Health Challenge hosted by INMAR, a leading provider of technology- driven pharmacy management solutions in the USA. eScent® was recognised as the most ground- breaking idea in the competition and for having an exclusive market position on wearable sensory data collection related to the sense of smell.

During Tillotson's Churchill Fellowship in the USA, eScent®'s unique *'scent bubble'* was validated by psychiatrists and psychologists as a prodromal scent intervention that could help individuals manage triggers by recognising, avoiding and therefore preventing the risk of an acute mental health relapse (such as bipolar affective disorder) through the use of stress alleviating and sleep enhancing scents[3]. eScent® can also be used to treat behavioural problems[4], encourage appetite and recall autobiographical memories in individuals with dementia. Alternatively, if pulsed intermittently, it can be used to test our smelling capabilities and potentially help diagnose the early stages of Huntington's or Alzheimer's disease, since the sense of smell is the first sense to deteriorate in such diseases.

A former Reader in 'Sensory Fashion' at Central Saint Martins, University of the Arts London, Tillotson is now working full-time on eScent® and will explore other markets beyond healthcare, including personalised fine fragrances for luxury brands, retail, sportswear, entertainment, learning, Augmented Reality and Virtual Reality. She recently gave a keynote on eScent® at Nanobiotech Montreux in Switzerland and to the medical community at the Royal Society of Medicine meeting on 'Telemedicine & ehealth 2015: Wearables and the Caring Home'.

Dr Jenny Tillotson can be contacted by email at jrt48@cam.ac.uk and her CEB profile can be accessed at www.ceb.cam.ac.uk/directory/jenny-tillotson

CEB Alumna Dr Wendy Alderton Abcodia Venture

Dr Wendy Alderton

Dr Wendy Alderton is an alumna of CEB. She started a PhD in Biotechnology in 1989 and graduated in 1993. She immediately joined the Wellcome Trust as a Scientist. Three years later, she moved to GlaxoSmithKline as a Research Scientist for four years. After gaining much experience, she started leading and managing departments at a few other companies. In 2009, she founded her own company CB1 Bio Limited. The company was involved in consultancy contracts delivered for pharmaceutical, biotechnology and university clients with a specialty in pharmacology, drug re-profiling and zebrafish testing.[5]

[1] Hwang, E. & Shin, S, 2015, The effects of aromatherapy of sleep improvement: A systematic review and meta-analysis, *Journal Alternative and Complementary Medicine,* 2015, 21: 61-68.
[2] Weber S,T.& Heuberger E, 2008, The Impact of Natural Odors on Affective States in Humans, *Chem. Senses,* 2008, 33: 441–447.
[3] Sarris, J & Byrne, GJ. A systematic review of insomnia and complementary medicine, *Sleep Medicine Reviews,* 2011, 15: 99-106.
[4] Fung, JK, Tsang H, Chung, R. A systematic review of the use of aromatherapy in treatment of behavioral problems in dementia. *Geriatrics Gerontology International.* 2012, 12: 372-382.

In 2009, she joined Abcodia Limited as a Chief Science Officer. Abcodia Limited is a clinical stage company involved in the commercial development of novel, scientifically validated tests for the early detection of cancer. ROCA® Test is the initial output from the company. It is used in the early detection of ovarian cancer. The company is also tackling early detection methods of lung, colorectal and pancreatic cancer.[6]

Dr Wendy Alderton is involved in a project based on pancreatic cancer. One of the studies carried out was 'CA19.9 Profiles in Samples Pre-dating Pancreatic Cancer Diagnosis: a Nested Case Control Study in the UK Collaborative Trial of Ovarian Cancer Screening (UKCTOCS)'. There are presently no screening techniques for the early detection of pancreatic cancer. However, diagnosis may help in higher rates of surgery and consequently help in survival. CA19.9 is the most common biomarker used in clinical diagnosis of pancreatic cancer. The study focused on CA19.9 levels prior to diagnosis of pancreatic ductal adenocarcinoma (PDAC) in a nested case control study within UKCTOCS. It was concluded that CA19.9 alone might be restricted as a screening marker due to insufficient sensitivity/specificity for population screening and a documented inability to distinguish pancreatitis from PDAC. However, CA19.9 may be useful in early diagnosis of pancreatic cancer when coupled with other biomarkers.[7]

[5] www.linkedin.com/in/wendy-alderton-3116411
[6] www.abcodia.com/
[7] www.abcodia.com/docs/aacc_wendy_alderton.pdf

Overview

Industrial interest in the Department continues to grow. This is emphasised by the significant increase in industrial representatives from large and small companies, attending the Research Open Day, as reported elsewhere in CEB Focus.

Several potential collaborations are under discussion ranging from microbiology to wearable technology.

Company Highlights

Emulsion fuel technology provider SulNOx Fuel Fusions has partnered with Lloyd's Register (LR) to provide verification, testing, technical support and consultancy services.

John Faraday and Stephen Bamford kindly helped out with the recent CUCES Careers Panel Event. Coming from distinctly non-chemical engineering backgrounds, they added a colourful touch of diversity to proceedings.

A workshop with Synthomer is being planned jointly with chemistry department for March 2016.

Synthomer is one of the world's major suppliers of latices (sic) and speciality emulsion polymers supporting leadership positions in many market segments including coatings, construction, textiles, paper and synthetic latex gloves.

They wish to draw on the expertise of the two departments to address 'grand challenges' that they face, such as cost-effective real time measurement of monomer conversion.

ABB has generously donated an experimental rig to help with teaching process control to undergraduates[1]. It will be installed in the Teaching Lab of the new building and third year students (Part 2As) will be using it in the next academic year.

In the process control course of Part IIA students learn to describe process dynamics with mass or energy balances, and design stable process control systems. The rig serves as a practical, experimental component for the course and as an educational exercise for ABB's

graduate engineer training scheme; the graduate engineers made it, supervised by experienced engineers.

ABB is a leader in power and automation technologies that enable utility, industry, transport, and infrastructure customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in roughly 100 countries and employs about 140,000 people. ABB is involved with several UK universities and has made philanthropic donations to top universities. ABB is a member of the Teaching Consortium of companies, which supports the department in terms of graduate recruitment and the practical training of undergraduates.

Impact

On the Road…

Graham Dransfield (Knowledge Transfer Facilitator) visited Kent Science Park in Sittingbourne in September. A former Shell Agro-Chemicals site, it has been host to a growing number of biotechnological, pharmaceutical and other companies since 2002. Some strong potential interactions were identified.

Graham's talk to the Teesside Branch of the Royal Society of Chemistry entitled 'Herding Cats', loosely based on his experiences to date as a Knowledge Transfer Facilitator, was well received. The talk was intended as a light hearted warm up for the main speaker, but nonetheless generated significant interest in the activities of CEB and further invitations to visit local companies.

H2020/MSCA

It is encouraging to note that the number of CEB submissions to the Chemistry Panel for the Maria Sklodowska Curie Actions (MSCA) has risen from 2 in 2014 to 5 in 2015. The scheme is very competitive with a funding threshold of above 90%, but Cambridge has a strong track record, as reported in previous editions of CEB Focus. Hopefully, the workshops held during the summer have helped lead to some successful applications in the most recent call, which was evaluated during November. Candidates should be informed in February.

Cambridge Infinitus Research Centre launched

The Department of Chemical Engineering and Biotechnology received a £4M research donation from Chinese health giant Infinitus, which includes a contribution to the construction of the Department's new building in West Cambridge. The grant is in support of the new Cambridge Infinitus Research Centre (CIRCE) headed by Professors Clemens Kaminski and Alan Tunnacliffe[2].

CIRCE aims to analyse the biological activity of polypeptides and polysaccharides derived from plants and fungi. 25% of all modern medicines are derivatives of natural products and a major focus in CIRCE will be the study of molecular regulators of protein homeostasis in treatment of protein misfolding diseases.

CIRCE has begun operations ahead of the departmental move. Gabi Kaminski Schierle, head of the Molecular Neuroscience Group in the Department, acts as CIRCE's Director of Operations. Gabi brings expertise in the molecular pathology of neuronal degeneration and oversees overall operations in the Centre. Dr. Chiara Boschetti, an expert in molecular biotechnology, heads biological research activities. With collaborators from other internationally ranked research establishments, the CIRCE research team will use state-of-the-art molecular biology and imaging technologies together with high-throughput screening methods to discover functional peptides from naturally derived products and to characterise their mechanism of action at the organism, cellular and molecular levels.

Professor Clemens Kaminski says: *"I am absolutely thrilled to think of the opportunities that CIRCE will bring to us and our Department. Infinitus is a world leading biotechnology company and I have been greatly impressed with their vision and enthusiasm to drive this exciting new venture forward. The importance of learning from nature on how to design molecules that*

might combat disease is exemplified through this year's award of the Nobel prize in Medicine to Chinese researchers who discovered Artemisinin, a drug that is wholly derived from plants, and that is presently the most effective against malaria."

China and the UK fund emerging Industries

China and the UK signed a collaboration agreement to create the Sino-UK Emerging Industries Development Fund. The deal was signed at the China-Britain Business Summit, on 21 October 2015 by Dr Simon Haworth (Dynasty Biotechnology Ltd), Mr John Liu (MD, China Equity Group), and CEB Emeritus Professor Chris Lowe, in the presence of Dr George Freeman, Minister for Life Sciences.

With an initial investment of £100M and three subsequent ones of £200M, the Fund intends to commercialise UK science in Chinese markets, investing in late-stage, China-relevant, and China-ready technology, or in established science-based businesses. The deals are sourced from target markets in biotech, cleantech, and agricultural technology by a team of British and Chinese industry leaders.

Dr Freeman stated: *"With a population of more than one billion and a rapidly developing economy, China is set to become the world's fastest growing healthcare market. Today's £2 billion trade package for UK exports in research, hospital construction, training, diagnostics and drug discovery shows the huge potential of UK/Chinese Life Science trade[3]."*

[1] www.ceb.cam.ac.uk/news/news-list/abb-rig
[2] www.ceb.cam.ac.uk/news/news-list/circe
[3] www.gov.uk/government/news/boost-for-global-health-as-uk-and-china-agree-2-billion-of-healthcare-trade-and-investment-deals

Professor Hall awarded Allen Grant

Professor Lisa Hall

Professor Lisa Hall's group is one of five groups that were awarded the Paul G. Allen Family Foundation Distinguished Investigator grant - $7M over three years - to investigate the roots of Alzheimer's disease[1].

The disease currently afflicts 850 000 people in the UK (1 million expected by 2015) by gradually diminishing their memory, language and problem-solving skills. Proposed treatments fail the clinical trials at a staggering 99.6%.

Alzheimer's disease damages the brain's white matter (the tissue that surrounds and insulates neurons) and forms characteristic "tangles" and "plaques". Lisa's group will use a combination of new imaging methods, biosensors, and cutting-edge models to identify how the damage occurs and how it affects the disease's progression. White matter lesions may be an ideal biomarker as well as an early treatment target for Alzheimer's, since they appear prior to symptom onset and can be monitored non-invasively.

$2.9M Grant to Professor Bahn

Professor Sabine Bahn

Professor Sabine Bahn, Director of the Cambridge Centre of Neuropsychiatric Research (CCNR), was awarded a follow-up grant of $2.9M from the Stanley Medical Research Institute to continue her pioneering work on identifying the molecular basis of major neuropsychiatric disorders[2].

The Bahn group is part of the Stanley Program for Epidemiology, Prevention and Treatment of Schizophrenia (SPECTS): an international collaboration between eight laboratories that trace the risk of developing psychiatric disorders to gene-environment interactions.

The group focuses on schizophrenia, bipolar affective disorder, major depressive disorder, and autistic and anxiety spectrum disorders; they use biomarkers and novel target discovery to translate research findings from the bench to the patient bedside.

Dr Moggridge awarded British Heart Foundation Grant

Dr Geoff Moggridge

Dr Geoff Moggridge has been awarded over £750K by the British Heart Foundation (BHF) to develop novel artificial heart valves that could replace permanently damaged ones[3]. This is a joint project between the University of Cambridge, Bristol University and the Freeman Hospital, Newcastle upon Tyne.

Currently, the 300 000 artificial valves fitted every year are mechanical; they are more durable than the biological alternatives, made from animal tissues. However, they require lifelong medication to prevent blood clotting around the valve - a requirement the novel valves aim to eliminate.

Dr Moggridge stated: *"Surgeons have been successfully replacing faulty heart valves with man-made valves for many years, giving patients longer, more active lives. We hope that with this new valve we can offer people needing a valve replacement a better quality of life and a chance to live even longer."*

Hilary Fabich receives Young Investigator Award

Hilary Fabich

PhD student Hilary Fabich won the Sir Paul Callaghan Young Investigator Award at the recent International Conference on Magnetic Resonance Microscopy for her talk titled "Using MRI to investigate fluidised bed reactors"[4].

She says: *"During my PhD I have modified a medical MRI technique, ultrashort echo time (UTE) MRI, which we have used to image bubble formation in a model fluidised bed reactor. These images can provide new information about bubble behaviour in these types of reactors which may help us tailor mathematical models to better understand these systems. If we can more accurately model fluidised bed reactors, we will be able to increase the reactor efficiency. Having my abstract selected to present to an audience of many of my research idols and mentors was an exciting opportunity for me as it offered a chance for honest and informed feedback on my work from those same people. Being awarded the Sir Paul Callaghan Young Investigator Award offered reassurance that my research is of interest to a broader community and is moving my field forward. The experience has triggered some fun and interesting discussions and has helped me to engage in new, at least for me, regions of the MR community."*

CBE Investiture for Professor Lisa Hall

Professor Lisa Hall

Professor Lisa Hall was appointed *CBE* (Commander of the Most Excellent Order of the British Empire) in the Queen's Birthday Honours list announced on 13 June 2015. Her investiture took place at Windsor Castle on 8 December 2015, with the Duke of Cambridge, on behalf of The Queen, presiding at the ceremony[5].

Lisa Hall is Professor of Analytical Biotechnology and Head of the Cambridge Analytical Biotechnology Group in the Department of Chemical Engineering and Biotechnology. Her research work is into heterogeneous analytical systems and is focused on understanding how biology can be interfaced with electronic, mechanical and optical systems. She has been awarded the SAC Gold Medal in Analytical Chemistry by the Royal Society of Chemistry.

[1] www.ceb.cam.ac.uk/news/news-list/adi-grant-aug15
[2] www.ceb.cam.ac.uk/news/news-list/bahn-smri-oct15
[3] www.ceb.cam.ac.uk/news/news-list/gdm-heartvalve
[4] www.ceb.cam.ac.uk/news/news-list/hilary-fabich-award-aug15
[5] www.ceb.cam.ac.uk/news/news-list/lisahallcbe

Reflections on Leadership by BT Group CEO

Gavin Patterson graduated from Emmanuel College with a MEng degree in 1990. After graduating, he worked for Procter and Gamble for nine years, rising to become European Marketing Director, and Telewest (now Virgin Media) where he was Managing Director Consumer Division.

In 2004, he joined BT as Group Managing Director, Consumer, before joining the BT board and becoming CEO BT Retail in 2008. Under his leadership, BT Retail launched BT Sport; drove growth in IT services and built the largest Wi-Fi network in the UK and Ireland.

In 2013, he was appointed CEO BT Group where he is leading the fastest rollout of superfast broadband in the world and the proposed acquisition of EE, which will create the UK's leading converged communications provider. He is currently a Non-Executive Director at British Airways and a Trustee of the British Museum.

Given the experience that Gavin has gained since leaving Cambridge, we caught up with him recently to ask for his personal thoughts on careers and leadership and here are his top tips:

Find your cause: Keep searching for work that matters to you and when you find it, do it with everything you've got. When I left Cambridge, I knew I wanted to go into general management. I had my own business as a sideline at University, which I loved. The way of analysing and thinking that my Engineering degree gave me helped me to run my business and vice versa.

Create great teams and grow others: Build capability, grow succession and importantly bring in people from a variety of backgrounds and industries. This will give you the diversity of thought you need for decision-making and the formulation of ideas within your organisation.

Make better decisions: Be efficient. In reality there's a large number of decisions that pass over your desk. You need to identify and focus on the most important ones and make instinctive, agile decisions on the others so you don't slow the organisation down. Remember it's better to make a decision than not and to spend more time on the decisions that will really make a difference.

Find the signal in the noise: Respond to the right thing. You need the ability to be able to manage huge amounts of information and know when and what to act on and respond to. So you need to learn to filter and be really clear on your priorities.

Start and end with the customer: If you don't have a customer you don't have a job. Watch how people buy and use your products so you really understand their mind- set. Make sure you are aware of your competitor's products and services and look at other categories to see how all of this translates to your business. And if customers feel the need to complain, encourage them to complain to you.

Build personal resilience: Maintain energy and drive and develop a tough core. It's important to be healthy both physically and mentally. This will help you respond to pressure and the demands of daily life. Learn not to take criticism personally and also find the right work life balance. It's crucial you create time for your family and friends.

Maintain an edge: Set a vision and goal for the company, taking calculated risks rather than play it safe — and inspire people to reach it. When BT launched BT Sport two years ago, the list of failed new broadcasters was pretty long and many commentators thought we'd lost our heads. We had the courage of our convictions and it's worked well for BT, changing the landscape of sports broadcasting in the UK.

The professional profile of alumnus Gavin Patterson can be accessed on www.btplc.com/Thegroup/Ourcompany/Theboard/Ourboard/GavinPatterson/index.htm

Alumnus Dr Barry Martin reminisces about the 60's

Dr Barry Martin

I have just finished reading Peter Varey's splendid book "Life on the edge" and feel quite emotional. I was a research student in the Department working with Anthony Pearson from 1965 to 1969 and then as a research associate until 1971.

I wish I had known more about Danckwerts. He often joined us for coffee on the top floor, where some of us had desks, but he rarely had much to say. Robin Turner, Ron Nedderman, Nigel Kenny, Peter Hutchinson and Anthony did most of the chatting. The staff has their own room but frequently joined us upstairs. The wonderfully efficient Margaret Sansom was also a regular.

Here are four of my memories of Danckwerts:

During my first year, my wife and I were invited to an At Home at Abbey House. Unfortunately, I got the date wrong and we arrived one month too soon. Danckwerts opened the door and gave us a quizzical look. Then, Lavinia appeared and immediately guessed what had happened. After some merriment, they asked us in and opened a bottle. We spent a very pleasant hour or two with them; Lavinia was charming. Unfortunately, Professor did not keep it to himself and next morning I was a figure of fun in the Department. We attended a few more At Homes in subsequent years, arriving on time. I do so remember Lavinia's meringues.

I had the privilege of being one of the first people to go online to the Atlas computer. Eric Much of the computer lab asked me to be a guinea pig when he saw how much batch computing I was doing. There was no obvious place for a teletype machine, and it was placed in a corridor near the staff room. They were quite noisy machines, and once when I was typing the staff room door opened and Danckwerts said: *"Do you think the progress of science could be halted while we have a meeting?"* After that my teletype was banished to a little alcove under the stairs; it was pretty cold there in winter and I had to wrap up.

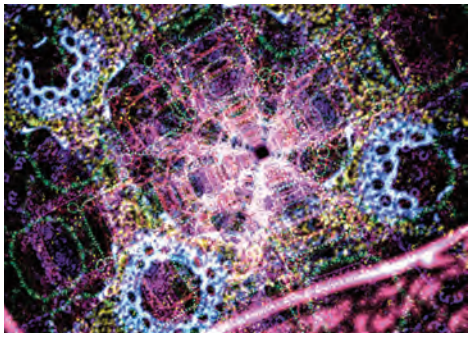
By 1967, Anthony had taken to growing long sideburns and wearing flower- power ties. His research students did likewise. Danckwerts was quietly amused.

Professor Art Metzner from Delaware has some views on how the running of the Department might be improved, and a meeting was arranged in the staff room where he put forward his views. Danckwerts listened in silence, simply saying at the end *"I'm bloodied but unbowed".* He preferred a relaxed atmosphere, as it proved to be productive of ideas in his own experience, whereas Art favoured a more puritanical work ethic. He expected the lights in the Department to be burning all night. It was a pity that it happened at all; Art was a lovely man who had totally misjudged the situation.

I have happy memories of my time in Cambridge. They were a pleasant lot in the Department (except during their interrogations at our weekly seminars which were known to be inquisitorial). Anthony, his wife Emma and Margaret Sansom were extremely kind to my wife and me.

I did not pursue a life in Chemical Engineering. After a couple of years at Rice University in Houston, I decided it was not for me and became a Mathematics lecturer at Aston University. I retired in 1998 and had long since lost touch with friends from Chemical Engineering. The book brings it all back, and I am indebted to the author. I shall take it on holiday and read it all again.

In the shadow of that, I am known in the wider world as the inventor of Barry Martin's Hopalong Orbits Visualiser. Google it!



Barry Martin's Hopalong Orbits Visualiser

CEB Lunchtime Career Talks: Lent Term

Thursday 28 January 2016

Dr Gary Smith, INVISTA Intermediates Vice President of Sustainability: *"Managing Technical Uncertainty and Risk to generate Business Value."*

Managing Technical Uncertainty and Risk successfully is at the heart of being a practicing process engineer. This talk will aim to address real industrial examples and identify the core principles. The speaker will also illustrate the different Risk Management approaches for each stage of the product development: from discovery/R&D through to final commercialisation.

Thursday 25 February 2016

Lorraine Reddington, Senior Engineer at GSK, Manufacturing Engineering Capital Projects: *"What Do Medicines Mean to You? A career in the Pharmaceutical Industry"*

Lorraine will give an introduction about GSK and the meaning of medicines. In addition, GSK's involvement with vaccines, pharma and the costumer will be explained and product examples will be used to illustrate this. Furthermore, there will be examples of chemical engineering jobs at GSK and finally, the opportunities for graduates at GSK will be discussed.

CUCES (Cambridge University Chemical Engineering Society) Annual Dinner 3 March 2016

The dinner will take place at the Royal Cambridge Hotel, with pre-drinks starting at 19:00 and dinner at 19:30. There will be port served afterwards. The event is kindly sponsored by Shell (www.shell.com) and Schlumberger (www.slb.com).

Christmas at CEB

CEB Staff Christmas Party at Selwyn College (17 December 2015)

CEB Coffee Club Christmas Party at Social Room in Pembroke Street, led by Debbie Jacobs and the Catering Team (18 December 2015)

1952 – 2015: 63 Years in Chemical Engineering

Emeritus Shell Professor John F. Davidson, FRS, FREng, FIChemE, former Head of Chemical Engineering at Cambridge (1975-1993)

I entered the Department as a junior staff member (University Demonstrator) in 1952, almost wholly ignorant of Chemical Engineering. The Shell Professor, T R C Fox, who knew little about Chemical Engineering, had trained via the Mechanical Sciences Tripos after which he spent a few years at ICI Billingham working on the high pressure Haber-Bosch ammonia synthesis process, then new. Fox said that you walked quickly past a valve, because the spindle might become a projectile under the 200 atmos working pressure. When King George V visited the Billingham plant he observed that one of the big buildings had no roof. A plant operator explained: 'It did 'ave a roof but we blew the b ….r off". Thus Fox was very conscious of safety. In this as in many other ways he was ahead of his time. Fox determined to have a high intellectual standard in the Department, important for proper recognition in Cambridge. Denbigh, the author of the admirable book on Chemical Equilibrium and the first staff appointment, was new to Cambridge; he did not feel entirely welcome. He dined at a college which shall be nameless and sat beside the Master whose only conversation at dinner was to inform Denbigh that 'there is no place in Cambridge for applied science'.

My ignorance of Chemical Engineering was shared with other members of the staff except for Peter Danckwerts who succeeded Fox as Shell Professor: he graduated in Chemistry at Oxford and had a very distinguished wartime career leading a Royal Navy bomb disposal team for which he was awarded the George Cross. He then spent a year at MIT learning about Chemical Engineering. The rest of us had to learn in a hurry from admirable American text books – Hougen & Watson, Brown, Sherwood & Pigford etc. There were some advantages: if you were giving a lecture course and were only a couple of lectures ahead of the students, you could appreciate their difficulties and, quite often, learn from them.

In 1955 the Department was in difficulty. Sellers, our only real Chemical Engineer on the staff - he had been manager of the Manchester oil refinery and had worked in a refinery in the Middle East – left to become Professor at Swansea. Danckwerts went to the UK Atomic Energy Authority, then a world leader. Denbigh took a Chair at Edinburgh. Fox was unwell, so teaching of an intake of about 30 students a year was done by Denys Armstrong and me. Denys, a contemporary of mine as a student in Engineering, was an admirable colleague: he gave excellent lectures, looked after the Assistant Staff, compiled the timetable, arranged college supervisions for all students and managed the finance: 'your research grant runs out in six months, would you like me to spend it for you?'

In 1957 I became Steward of Trinity, faced with the task of rebuilding the College kitchen, whose layout was essentially as built in 1605. This was a challenge: e.g. all the glassware was carried out (in the rain) into Nevile's Court, about thirty yards from the Dining Hall, to be washed up.

At that time I began research in fluidisation, which happened by accident: J M.Kay, the co-author of the excellent book on Fluid Mechanics (Kay & Nedderman), had built a small fluidised bed for teaching. This experiment was near an academic experiment on large air bubbles in water. The proximity of these experiments suggested the plan of injecting an air bubble into an air-fluidised bed and observing the rise velocity. Thus began two Tripos research projects which showed that a bubble in a fluidised bed rises much as in water, having the same rise velocity: moreover the bubble shape is of spherical-cap form, much the same in water as in a fluidised bed. Providentially David Harrison, who joined the teaching staff in the 1950's, took up this line of work. It was he who, in the early 1960's, suggested we write the book 'Fluidised Particles'.

A later landmark was the Flixborough disaster. In June 1974, a large chemical plant near the Humber was completely destroyed, with twenty-eight fatalities, by a huge explosion and subsequent fires (see Fig. 1). The government appointed a Court of Inquiry; I was one of two technical members. I suddenly became a 'High Court Judge' listening to the submissions of QCs representing the parties involved. My legal colleagues in Trinity became respectful.

Fig 1. Plant after explosion ('The Flixborough Disaster' 1975 report of the Court of Inquiry)

The cause of the accident depended on hydrostatics, familiar to Archimedes. The plant included aerated reactors, to oxidise cyclohexane, a flammable liquid like petrol, at 8 bar pressure. There were six reactors in series, to get a good approximation to plug flow. One reactor had been cracked; it was removed and hastily replaced by a cranked pipe connected at each end to 28 inch diameter bellows, see Fig. 2. This worked for a few months and then, when the reactors were fully pressurised, the cranked pipe buckled, tearing off the bellows, leaving two 28 inch holes through which cyclohexane flowed from the large inventory in the reactors and associated vessels, at 8 bar. The two opposing jets of cyclohexane must have interacted and mixed with air, giving a cloud containing cyclohexane vapour, droplets and air. The cloud did not immediately explode because it was in a flame-proof area. Chemists in a nearby laboratory saw the cloud, ran out of the building and escaped. Operators in the control room were unaware of the vapour cloud, which grew and drifted to a furnace which ignited the cloud with the power of 20 tonnes of TNT. This destroyed the control room, killing the operators and starting great fires which, together with the explosion, destroyed the entire factory, see Figure 2 below.

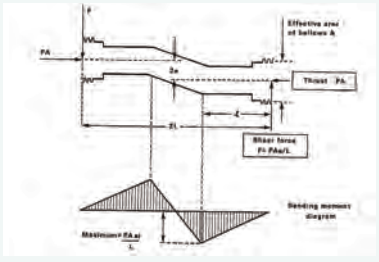


Fig 2. A sketch of pipe and bellows assembly showing shear forces on bellows and bending movements in pipe (due to internal pressure only)

The cranked pipe and bellows, shown in Fig.2, was basically unsound. The instructions of the bellows manufacturer were quite clear: a bellows should be firmly supported at *both ends*. With the arrangement of Fig. 2, the cranked pipe was flimsily supported on scaffold poles. Moreover, the two bellows were necessarily out of line, because of the need for gravity flow of cyclohexane from each reactor to the next. The hydraulic thrust, due to the 8 bar internal pressure within each bellows, was about 3 tonnes, giving a large bending moment on the thin walled cranked pipe. Although the plant had run for some months with the cranked pipe and bellows in Fig. 2, the pressure had, on start-up, drifted a little higher than normal, causing the cranked pipe to buckle and tear off the bellows.

Another landmark in my life was biotechnology. This began in the 1950's with a Tripos project on *chlorella*: the supervisor was Danckwerts. One of the students was Peter King: his project caused a laboratory fire, news of which was kept from Fox. Peter King did rather badly in the Tripos, often a precursor to success in later life; he subsequently became a director of ICI Billingham, using his chlorella experience to initiate a project to grow animal feeding stuff from methanol, using a huge fermenter, 10 m dia x 60 metres high.

This became commercially unviable because of (1) rise in methanol prices and (2) fall in soya bean prices. But it started us on biotechnology and led to a post in the Department, as follows. Mrs Thatcher was much vilified for cutting back University funding, but she did invent 'New Blood' posts, University jobs for under 35s. Sweet talking to a government research establishment elicited support for a 'New Blood' post in our Department, leading to the appointment of Professor Chase. This helped us to get support for what became the Institute of Biotechnology, at first part of the Department, then separated and subsequently re-joining us to form the Department of Chemical Engineering and Biotechnology. The unity will be complete when we move to the new building.

What of the future? The move to West Cambridge will bring together the occupants of three buildings (1) Pembroke Street, representing traditional Chemical Engineering (2) Tennis Court Road, the Institute of Biotechnology and (3) the MRI Laboratory near the Cavendish. We can expect that the synergy of these three units will generate new and exciting developments.

Michaela McNeill: A Lady of many Talents

Michaela McNeill, Receptionist

I have been working in the Department for twenty years as the receptionist on the New Museums Site. Before that, I worked in a number of office jobs in businesses, which included printing, industrial flooring, and for a time I worked for the National Farmers' Union, an insurance company that was primarily for farmers. I had been looking for a job in Cambridge for three years before I came across the job in the University. In fact, it was purely by chance and luck that I found it as I was due to go on holiday at the time and I was going to give it a break from job searching. I got selected for the interview and here I am twenty years later!

I have actually liked working here because you meet different people from different walks of life without the need to go too far from your doorstep. You can meet people from Australia and the United States as well as someone from the Far East through to someone here in the UK.

When I am not working, I like reading, letter writing to penfriends from all over the world, gardening and cooking. I like baking cakes and recently it was my parents' wedding anniversary in which my sister and I made and decorated the cake. In fact, my sister makes and decorates cakes for special occasions as a hobby and she runs her own business in bakery and cake making based on costumers request. So, if you have that special event coming up, please let me know! It was a big occasion as it was my parents' 50th wedding anniversary and people came from far and wide for this special occasion, including my brother and his family from Brazil.

I am an Authorised Lay Minister, specialising in Worship Leading which involves me leading services, taking Home Communion which is when I go into people's homes to give them Holy Communion (Eucharist, Lord's Supper) and acting as support to my local priest as well as being the church secretary.

I also like karate. I train at Shotokan karate once a week, which I have been doing ever since I was a teenager. At the moment, I am a 1st Kyu (brown belt with two white stripes). This is one step from being a black belt. Hopefully, I would like to grade to the next level in the not too distant future. Karate is really good for your self- confidence, teaches you to respect other people as well as keeping fit.

A few years ago, I wrote my own book called A Question of Honour, which can be purchased on Amazon (www.amazon.co.uk/A-Question-Honour-Michaela-McNeill-ebook/dp/B004T52M80). This is an e-book, which can be read on a Kindle or similar electronic device as well as a PC.

My most recent achievements have been passing my Functional Mathematics and Book-keeping courses, which I have done as evening classes at local colleges. Considering I left school with no Mathematics qualifications to my name, this is a great achievement.

Michaela's Parents' Wedding Anniversary Cake

Professional Mentoring Scheme to be launched in CEB

CEB is launching a post-doc mentoring scheme, matching a post-doc with a more seasoned investigator, who will offer advice and complement the relationships the post-doc has already developed within and outside the Department.

Mentoring is confidential and separate from the line management chain. Post-docs may choose to be open with their PIs about it, and can ask them for support in identifying development areas that they might want to work on with a mentor.

Mentors are volunteers; their role is not solely to offer advice, lessons learned, or to 'spoon feed' the mentee, rather to encourage proactivity, responsibility, and ownership of one's career. The skills of mentors include: finding common ground, listening and observing, questioning to understand, and giving advice (where appropriate or when requested). The flow of learning is two-way in a mentoring relationship, as mentors can improve their ability to analyse their own experiences, gain insight into the lives/situations of others, and develop their inter-personal skills.

CEB has recently pledged £1k funding to help set up a formal mentoring pilot scheme for post-docs in the Department with the help of the Office of Post-doctoral Affairs. The funds will support the staff for the scheme and will provide face-to-face (and, in the near future, online) mentorship training sessions for mentors and mentees. CEB has also received full support from the University HR team for this initiative.

We have interviewed two seasoned and respected CEB academics who have volunteered to offer career advice: Emeritus Professor Chris Lowe (see interview below) and Dr Linda Allan (whose interview will be featured in the next issue).

Please contact Libbi Johnson at Libbi.Johnson@admin.cam.ac.uk if you wish to participate in the scheme.

Why did you become a mentor?

Emeritus Professor Chris Lowe

To enable me to transfer some of the unique experience I have accrued over the last 40 or so years in both academia and entrepreneurial business to younger people in order to inspire and motivate them to consider similar options.

How many individuals have you mentored and at what professional level?
Countless undergraduates, Master's and PhD students, and academic and commercial staff, including some retirees and those looking for life-changing options.

What do you think the mentees get out of it?
Some, probably nothing; most, I hope good advice, and a few, life changing options.

What did you get out of it?
The satisfaction that a career spent at the interface of academia and industry has been worthwhile and in some cases appreciated.

What are key skills in a person who wants to become a mentor?
The ability to listen carefully to the mentee, and give advice that is both appropriate and timely.

Is there anything else you want to mention?
I enjoy mentoring; it is often exceedingly satisfying to both parties.

New Sensor CDT Administrator:

Caroline Yan-Man-Shing

Caroline

"I've recently taken up the role of Senior Administrator at the Sensor CDT. Previously, I studied Law with French and then went on to work in social housing before leaving London for the mountains of Snowdonia. With a newfound interest in science and looking for a new challenge, I returned to university to study Physics at Aberystwyth.

At the CDT, I'm involved in the day-to-day running of the MRes programme. This involves dealing with enquiries, timetabling and updating the Moodle site with course material. As the CDT is only in its second year, there is plenty of scope to bring in fresh ideas. I have had the opportunity to look into the research interests of academics engaged in a sensor-related field in areas as diverse as bio-physics, plant biology, clinical science and engineering, all with the aim of inviting them to the CDT to deliver a bespoke lecture to our students.

In the weeks and months to come I will be updating the website, and getting to grips with the reporting requirements and financial administration. And of course, there's next year's Sensors Day conference to start planning... ".

CEB joins Physics in a new Molecular Engineering Initiative

Dr Jacqui Cole

Dr Jacqueline Cole, the Head of Molecular Engineering, will lead a new initiative between CEB, the Cavendish Laboratory, and the UK neutron source (ISIS)[1,2].

Molecular Engineering is an emerging field that tailors material properties in the molecular scale, embracing rational molecular design and engineering concepts.

Initial projects include solar-powered 'smart windows' for energy sustainable buildings, advanced materials for optical data storage and ultra-fast telecommunications, light-activated molecular machines for nano-sensors, molecular containment of energy fuels and environmental waste.

Jacqui said: "I am delighted to be able to engage in a new joint research venture for CEB and Physics, at Cambridge, not only because Molecular Engineering is a topic that is close to my heart but also because it requires a truly interdisciplinary leading role. This can make best use of my Chemistry, Engineering and Physics skills and qualifications, to provide researchers with opportunities that cross-over traditional boundaries in academic disciplines, at such a level of intimacy and integration that product design at the molecular scale could lead to highly disruptive technologies. The timely move of the CEB Department to the West Cambridge site will naturally aid my role in encouraging research synergy with the Cavendish Laboratory."

Staff Arrivals, Departures, Birthdays and Long Service

Several people in the Department have been with us for around 20 years and we would like to acknowledge their hard work and commitment. Sharada started here on 17 July 1995, Michaela on 8 May 1995 and Helen Stevens-Smith in the Library around the same time, so they have notched up 20 years. Lee Pratt (workshop) has been here for 29 years, Wei-Yao and Zlatko for 21, and Vanessa will mark 20 years in March 2016. Roz started in the Materials Science Department in October 1985 and joined us in April 1996. *"30 years! You get less for murder!"* she says with a smile. John Gannon retired on 30 October 2015, after 15 years in CEB's Electronics Section. Wei-Yao Ma said: *"He is an invaluable member of our staff, and has always shown very positive attention to detail as well as being keen to deliver work of the highest standard over a wide range."* Professor Howard Chase retired on 31 December 2015. He joined CEB in 1984, became a Lecturer in 1986 and Professor of Biochemical Engineering in 2000. He was the Head of the Department from 1998-2006. Lyn Hurst in Accounts is also retiring. We wish them a happy retirement. They will always be a part of our family here in the Department. Emeritus Professor Chris Lowe became 70 years old on October 2015 and Professor Allan Hayhurst became 79 a month later. John Davidson, Emeritus Professor and former Head of the Department, will be 90 years old in February 2016. We wish them all a happy birthday!

[1] www.phy.cam.ac.uk/news/cavendish-laboratory-and-dept-of-chemical-engineering-biotechnology-announce-a-new-initiative-in-molecular-engineering

[2] www.ceb.cam.ac.uk/news/news-list/new-initiative-in-molecular-engineering

The oldest Cambridge Prank?

'Oldest and smallest of the Cambridge colleges' is the proud claim of Peterhouse. It may also be the college with the oldest recorded prank. Among its lofty alumni Peterhouse counts the poet Thomas Gray. A sombre member of the 'Graveyard Poets', he favoured works on death, mortality, and the finality and sublimity of the end of life. His masterpiece, 'Elegy Written in a Country Churchyard' introduced several popular phrases to the English language, including 'kindred spirit', 'celestial fire' and 'far from the madding crowd'. As befitted one of the predominant poets of the mid-eighteenth century, he was offered the post of Poet Laureate, but refused. A private individual, he preferred solitude and the quiet life of an academic suited him well. He returned to Peterhouse, his *alma mater*, and took up a fellowship.

He led a content enough existence, spending much of his time in his third-floor rooms overlooking the street and churchyard of Little St Mary's. By all accounts, apart from his poetry, Gray had but one love and one fear. The love was one for port, in which he was described as have a 'very pretty taste... but it did not suffice to make him more clubbable [literally, 'suitable for membership of a club' i.e. sociable]'.

His fear was fire. As might be deduced from his works, Gray was obsessed with death but not necessarily frightened of it. Fire, however, grew to be a morbid fear. At Peterhouse he had installed horizontal metal bars above his window-frame. Next to them he kept a coil of rope, so that in case of fire he could tie it to the bars and let himself down. This was a matter of common knowledge at Peterhouse and, combined with his unpopular demeanour, led to a cruel prank. Several students took advantage of his fear by placing a tub of water underneath his window during one cold winter night. They retired to a suitable viewing position and began to cry 'Fire! Fire!' Sure enough, they saw the window flung open and Gray, clad in his nightgown and cap, descended the rope into the waiting tub of icy water. This delighted the students but incensed Gray, who would never forgive the college.

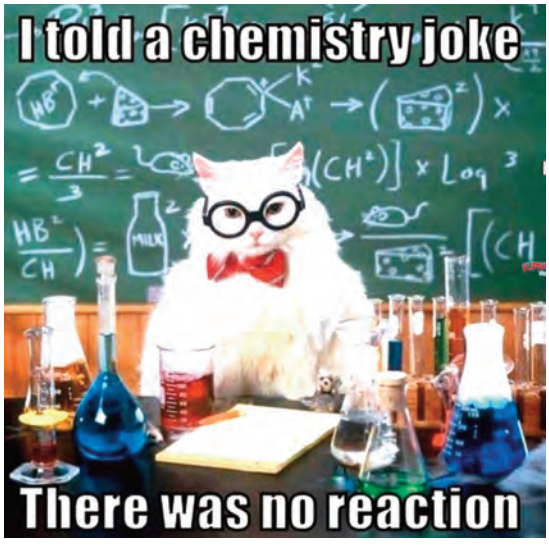
An account from the time, in a letter by Reverend John Sharp on 2 March 1756, suggests that the well-told story may have been embellished and that there was no tub of water:

Mr Gray, our elegant Poet, and delicate Fellow Commoner of Peterhouse, has just removed to Pembroke Hall, in resentment of some usage he met with at the former place. The case is much talked of, and is this. He is much afraid of fire, and was a great sufferer in Cornhill; he has ever since kept a ladder of ropes by him, soft as the silky cords by which Romeo ascended to his Juliet, and has had an iron machine fixed to his bedroom window. The other morning, Lord Percival and some Petreuchians, going a-hunting were determined to have a little sport before they set out, and thought it would be no bad diversion to make Gray bolt, as they called it, so ordered their man Joe Draper to roar out fire. A delicate white nightcap is said to have appeared at the window: but finding the mistake, retired again to the couch. The young fellows, had he descended, were determined, they said, to have whipped the butterfly up again.

Whatever the case, it is clear that so terrible was the experience that Gray immediately quit his post at Peterhouse and took a fellowship at Pembroke College, across the street, and still overlooking his beloved churchyard. The bars at Peterhouse remain to this day.

Cambridge Student Pranks, A History of Mischief & Mayhem, by Jamie Collinson

Chemistry Cat Comic



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