University of Limerick
Ollscoil Luimnigh

FACULTY OF
# Science & Engineering

Newsletter

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## In this issue:




# CONFIRM Launched

Minister for Business, Enterprise and Innovation, Heather Humphreys TD, launched the latest Science Foundation Ireland (SFI) Research Centre, CONFIRM - a 'smart manufacturing' research centre led by University of Limerick (UL) and involving 42 companies on Wednesday 16th May 2018. The centre is funded by SFI and industry to a value of €47 million, making it one of the largest new research and development centres in the country. The manufacturing sector is the second largest employer in Ireland and accounts for 24 per cent of total economic output - €110 billion in exports.

The CONFIRM SFI Research Centre is a consortium led by University of Limerick including the Tyndall National Institute, University College Cork, Cork Institute of Technology, National University of Ireland Galway, Athlone Institute of Technology, Maynooth University and Limerick Institute of Technology. The centre will comprise more than 200 researchers in smart manufacturing, including 106 new appointments. The CONFIRM SFI Research Centre is supported by 42 Industry partners including technology providers and end users from the Multi-National Corporation (MNC) and Small and Medium Enterprise (SME) sectors across Ireland. Speaking at the launch Minister Humphreys, TD, said: "Manufacturing is a key sector in our economy in Ireland, and in an evolving world where digital economies are becoming commonplace, it is crucial that Ireland can continue to deliver impactful research outcomes in this area. CONFIRM will benefit Ireland through enabling us to compete internationally, generating employment, enhancing student skills, and attracting new investment.


We are delighted to support this centre which will transform manufacturing in Ireland through the expertise of highly-skilled researchers" Commenting ahead of the launch UL's Professor Conor McCarthy, CONFIRM Centre Director, said: "This truly is a game-changer for Irish manufacturing competitiveness. The establishment of this SFI research centre will position Ireland to play a leading role in the global smart manufacturing revolution. This innovation will enable consumer-driven mass customisation, where future Irish products will be tailored to individual needs and delivered directly to them just hours after placing orders."

# Thesis in Three Competition


**Science & Engineering Student wins UL's Inaugural Thesis in Three Competition**

Congratulations to Jean Rizk, a PhD student in the Maths & Stats Department, who took a worthy first place in UL's Thesis in Three 2018 competition. Jean's talk, titled "Queueing for Healthcare" addressed analytical tools and techniques to address the challenge of queueing problems in Irish healthcare services. A total of twelve competitors – three from each of UL's four faculties – skilfully engaged the attention of the audience in three-minute slots, each supported only by a set of three slides.

The Faculty was represented by three students, chosen in a faculty-wide contest that featured twelve entrants. In addition to Jean, the School of Engineering's Darragh Walsh and Niamh Richardson also took to the stage, and scored highly in what was a keenly contested event. The winners were First Prize – Jean Risk, Second Prize – Aoife Gallagher EHS, Joint Third Prize – Sarah Watkins (EHS) and Darragh Walsh (S&E)

# Best Lecturer in Student Choice Awards

Congratulations to Cameron Hall on been selected as the 'Best Lecturer' in this year's Student Choice Awards.

# UL Impact Award

A UL/IComp research team together with EJ Access Solutions have received the UL Impact Award in the UL Innovation Awards ceremony held on 19 April 2018.

The UL team of Dr. Walter Stanley, Principal Investigator; Mr Ananda Roy, Senior Researcher; Dr Peter Hammond, Postdoctoral Researcher together with Dr Vincent Cooper, Product Manager EJ Access Solutions developed a lightweight access cover made from composite materials that could replace covers made from cast iron in certain applications


Photo (left to right): Dr Mary Shire, VP Research UL; Dr Ioannis Manolakis, IComp Centre Manager; Dr Walter Stanley, UL/IComp; Mr Ananda Roy, UL/IComp; Dr Vincent Cooper, EJ Access Solutions; Dr Des Fitzgerald, President UL

# IoP's 3 Minute Wonder Grand Final

Bernal PhD student Eileen Courtney won both the audience favourite and runner-up prizes at the IoP's 3 Minute Wonder Grand Final (3MW) at the Royal Institution, London. 3MW challenges researchers to explain their work in just three minutes, to a panel of established science communicators and an interested but non-specialist audience. Eileen's presentation was titled "2D materials and metals: a necessary combination".

## First International European University Design Contest Award

Analog Devices and Würth Elektronik awarded first prize to three projects in the First European University Design Contest launched for engineering students, Team Eppendorf from UL was one of these winners. The team comprised of Jasmine Hales (Year 3, BSc in Product Design and Technology, Ffion Lewis (Year 4, BE in Electronic and Computer Engineering), Aaron Moloney (Year 4, BE in Electronic and Computer Engineering), and Boonrasri Seeleang (Postgraduate Masters with Department of Electronic and Computer Engineering, via the ERASMUS MUNDUS LEADERS International Exchange Programme). The team was mentored by two members of Faculty from the Electronic and Computer Engineering Department, namely Dr Ian Grout and Professor Elfed Lewis.

The project, called Penthex involved creating a working electronically controlled precision oven for stabilization and/or accurate control of the temperature of micro- and milli- liter volume samples contained in Eppendorf tubes. Eppendorf tubes are used widely in Biochemistry labs e.g. for DNA forensic testing. A YouTube video made by the students for the competition can be downloaded from https://youtu.be/Y4xgmBSnxQ0. Analog Devices (ADI) are specialist in design and manufacture of electronic circuits and Würth Elektronik (WE), manufacturers of discrete electronic components, The project was selected as the UL entry in December and competed against five other teams from countries including Spain and Germany. The award ceremony was held in Munich in April 2018.

## 2018 Award for Industry Collaboration by the IEEE Computer Society

This is the first time the IEEE Computer Society Technical Council on Software Engineering (TCSE) Distinguished Synergy Award has come to Ireland. Previous winners include IBM Centre for Advanced Studies, Canada; Microsoft, USA and Fraunhofer Institute for Experimental Software Engineering, Germany. Lero was nominated by the Irish Computer Society. The TCSE Distinguished Synergy Award was presented at the 40th International Conference on Software Engineering in Gothenburg, Sweden, at the end of May and accepted on behalf of Lero by Prof Brian Fitzgerald.

# UL Awarded $250,000 Metal 3D printer by GE

The School of Engineering and School of Design joint proposal in the GE Additive Education Program was successful, leading to the award of a $250,000 Concept Laser Mlab 200R metal 3D printer. UL was among the five higher education institutions in global level that GE awarded a metal 3D printer, out of a total of 500 applications. This high value asset will enable education and research in the area of metal additive manufacturing, extending the Faculty's capabilities. This metal 3D printer is planned to be housed within the School of Engineering's Conceive-Design-Implement-Operate (CDIO) space, along with the existing polymer 3D printers, accessed by students and staff across various disciplines and Schools/Departments of the Faculty.

The winning proposal was jointly led by A/Prof Leonard O'Sullivan (School of Design), Senior Lecturer Dr Kyriakos I. Kourousis (School of Engineering) and Chief Technical Officer Dr Joseph Leen (School of Engineering).

GE Press Release:
https://www.ge.com/additive/press-releases/ge-additive-education-program-awards-machines-universities-and-colleges-germany


The Concept Laser Mlab cusing 200R system (https://www.ge.com/additive/additive-manufacturing/machines/dmlm-machines/mlab-cusing-200r

## The President's Excellence Awards

The President's Excellence Awards for Staff have been established to recognise outstanding contributions by staff (academic/research/ support) to the overall goals of the University and to the campus community. The awards acknowledge staff-members for their exceptional commitment and the part they play in the further development of the University of Limerick.

The winning award-recipients from the Faculty of Science and Engineering, for 2018 were:

**Innovation**
Dr Pat Frawley School of Engineering

**Leadership**
Professor Mike Zaworotko, School of Natural Sciences
Dr Jakki Cooney, School of Natural Sciences
Dr Ronan O'Higgins, School of Engineering

## Fellow of Association for Information Systems

Brian Fitzgerald was honoured as a Fellow of the Association for Information Systems award. The award was presented to him at the 38th International Conference on Information Systems (ICIS), Seoul, Korea.

## Alfred Werner Scholarship

Jane Marsden a recent graduate of the BSc in Industrial Biochemistry has been awarded an Alfred Werner Scholarship by the SCS Foundation in Geneva. The Foundation offers 8 to 10 scholarships of CHF 25,000 each as a one-time contribution to the cost of a 2-year Master study program. This opportunity targets foreign students in the top 10% of their undergraduate programs. For more information see the University of Geneva excellence fellowship website (https://www.unige.ch/sciences/en/enseignements/formations/masters/excellencemasterfellowships/winners2018/) and also on the SCS Foundation website (https://scs-foundation.ch/index.php/alfred-werner-fund/master-scholarships/scholarships-2018).

## ActionPoint Award for Computer Science Students


Limerick-based Tech Firm ActionPoint awarded UL Computer Systems student Jonathan Lloyd first prize for its annual FYP award in conjunction with UL. The award, which has been running since 2014, looks for excellence in commerciality and innovation in computer science final year projects, and is open to all 4th year students of Computer Science and Information Systems (CSIS) degrees at UL.

Jonatan Lloyd's FYP was a 'License Plate Recognition' system and was commended by ActionPoint's judges because of its "clean architecture and functionality". The Judging panel also commented on the "efficiency gains" that this system can offer over existing technology. Mallow Native Keith O'Brien claimed 2nd prize and €250 for his Intelligent 'Horse Racing Predictor' system.

## Award for Excellence in Service to the Community

Reinhard Schäler, a Lecturer in the CSIS Department, has won the 2018 Award for Excellence in Service to the Community. Reinhard was nominated for his work with the Rosetta Foundation and An Saol. Reinhard is founder and former CEO of the Rosetta Foundation, a charitable organisation whose mission is to relieve poverty and to develop healthcare and education through equal access to information and knowledge across the languages of the world. It helps not-for-profit organisations by connecting them with a worldwide network of volunteer translators.

Reinhard is also the CEO and co-founder of An Saol , an organisation which raises awareness of the challenges facing survivors and families of severe Acquired Brain Injury. He is currently leading a pilot project to establish a day-care centre which will offer an intensive neurological rehabilitation programme to survivors.

## Sir Bernard Crossland Poster Competition

Congratulations to Rachel Cahalane of the School of Engineering for taking silver at this year's all-island Sir Bernard Crossland poster competition. Rachel is part of the BioSciBer group in the Bernal Institute and her PhD research is funded by the IRC. Her supervisor is Prof Michael Walsh. The poster title was "Relating the mechanical properties of atherosclerotic calcification to radiologically classified density: A nanoindentation approach"
Rachel is pictured with Prof. Alojz Invankovic (left) host of the 2018 Sir Bernard Crossland Symposium at UCD and Prof. Noel O'Dowd of UL.

## UL Innovation awards (2018) – US patent award

The CSRC team of Vincent O'Brien, Brendan Mullane and Tony Scanlan received their US Patent Awards at the University of Limerick 2018 Innovation Awards on the 16th April 2018. The awards were presented to the recipients by Professor Des Fitzgerald, UL President, and Dr. Mary Shire, UL VPR.

**Title:** 'Mismatch and Inter Symbol Interference (ISI) Shaping using Dynamic Element Matching'
**Inventors:** Dr. Vincent O'Brien, Dr. Brendan Mullane and Dr. Tony Scanlan.
**Abstract:** The invention is to do with mismatch and ISI shaping in a data converter. The invention provides a dynamic element matching technique that incorporates both mismatch and intersymbol shaping. A digital decoder is provided that controls the number of 'on' and 'off' transitions so that the resulting signal does not contain noise or distortion. The element selection technique of the invention is suitable for high resolution multi-bit continuous time oversampling data converters.

## Design@UL Exhibition 2018

Design@ UL 2018 showcased some of the brightest new talent in Product Design and Architecture from the School of Design at UL. This showcase of undergraduate work, combined with our ongoing research activities and the hosting of the DRS2018 international conference in June, are all building a new School of Design with local, national and international impact and relevance. The Exhibition was opened by Professor Edmond Magner, Dean, Faculty of Science and Engineering on May 29th. The Exhibition was open to public from May 30 to June 29 2018.

## Prize Winners

1. Product Design Student Entrepreneur 2018, First Place, Presented by Enterprise Ireland. Winning Team: Brú. Keith Finn, Áine Cronin, Emma Dehaene and Pearse Coffey
2. Product Design Student Entrepreneur 2018, Second Place, Winning Team: BuddyButton. Jamie Kett Russell, Jason Gubbins, Kevin Dunne and Meadhbh O'Leary Fitzpatrick.
3. SAUL Best Thesis Award: Fiona McLernon. Thesis Title: The Other City: Juxtaposing conditions of human experience of a city
4. Best Emergent Product Design 2018 – Presented by Johnson & Johnson: Rebecca Mangan
5. Designer of the Year 2018 – Presented by Logitech Ireland. First Place – Jordan Kelly
6. Designer of the Year 2018 – presented by Logitech Ireland. Second Place – Ciaran Trotman
7. Designer of the Year 2018 – presented by Logitech Ireland. Joint Third Place – Stephen Johnson and Rachel McNamara
8. First Year Student of the Year 2016/17: Presented by AutoDesk/Procad – Katie O'Donnell


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# ESB announced a new partnership with the University of Limerick

At the launch of the Francis Turbine and ESB PhD programme were PhD students IndraneelRoy Chowdry, Cian Murphy, Mr Pat O'Doherty, CEO, ESB, Kirsten May, VP UL, and PhD student Hamad Hafizi

ESB announced a new partnership with the University of Limerick to support the brightest energy researchers in the University over the next four years. The partnership was announced at the unveiling of a new art installation which is created around the runner of an original Francis Turbine from Ardnacrusha Power Station. It generated clean electricity continuously for 66 years, before being decommissioned and replaced in 1995 and donated by ESB to UL in 2010.

The installation is located in the courtyard of the Bernal Institute at UL, where over 260 world leading researchers in the fields of Science and Engineering are based, including three PhD students, Cian Murphy, Hamid Hafizi and Indraneel Roy Chowdhury, whose energy related research will receive funding from ESB through the new partnership.

"I was a curious child, always asking 'why' and wondering about the world we inhabit, and it was that curiosity that led me to science," said Cian Murphy, speaking at today's launch of the partnership.
"My research focuses on the use of smart materials in composite structures and my vision is that one day we will all be generating our own clean electricity, just by walking down the street. I'm excited that my curiosity might now lead to a real benefit to our society, and this funding support from ESB will greatly assist me in this goal."

In addition, ESB will be an industry partner to Science Foundation Ireland-funded projects with the Centre for Marine and Renewable Energy at UL, with particular focus on real-time remote monitoring of substations and the remote operation of drones for inspection of transmission lines and wind turbines. ESB will also fund an annual visiting lecture which will bring international experts to UL to share insights and the latest international thinking on research to tackle climate change. Speaking at the announcement, Professor Kerstin Mey, Vice President, UL said: "Ireland's energy challenges are current. In UL we are involved in a race against time to develop novel, more sustainable, more efficient means of energy generation and use. The fact that ESB is supporting three PhD student scholarships in energy and sustainable development is testament to the urgency of this research. It is also a vote of confidence in UL, particularly our people in the world class Bernal Institute who are well placed to lead in this field."

Pat O'Doherty, Chief Executive of ESB, added: "The Turbine Installation at University of Limerick is a fitting reminder of the important role played by the Shannon Scheme in triggering major social and economic change in Ireland. One of the most visionary projects of the last century, it helped to change a way of life that had existed for generations. We at ESB continue to see electricity as a force for positive change, particularly in the context of tackling climate change. We are delighted to partner with UL to fund research that will help to make energy more sustainable, more efficient and ultimately provide customers with a better alternative to power all aspects of their lives. "The transition to a low carbon future will require creative and innovative solutions, and the work currently being carried out in the Bernal Institute at UL will support this."
ESB is leading the transition to a low carbon future by investing in low carbon and renewable generation, pioneering smart grid technologies to connect intermittent renewable generation with technology enabled customers and by supporting the electrification of heating and transport as a way of reducing Ireland's dependence on carbon intensive fossil fuels.

# €150 Million Secured for 200-MW of Grid Stabilisation Facilities in Offaly

At the end of April, Tullamore-based company Lumcloon Energy, headed by Nigel Reams, secured a partnership with two Korean companies, Hanwha Energy Corporation and LSIS, to install and operate grid stabilisation facilities in Co. Offaly. These leading Korean entities have several thousand employees specialising in energy storage and manufacture of large-scale electricity equipment and they will be investing €150 million and their expertise in the project. As part of the project, two 100-MW facilities, for which there are planning permissions and grid connections, will be built at the site of a former peat power plant at Lumcloon and near an operational plant at Shannonbridge (two key nodes of Ireland's electricity grid).

These developments are the by-product of current research at the University of Limerick by Dr Robert Lynch and Prof. Noel Buckley. Their team, in the Department of Physics and Bernal Institute, is active in several areas of research and development – including Electricity Grid Stabilisation, Integration of Energy Storage, Advanced Devices for Monitoring of Batteries, Stable High Energy Density Electrolyte for Vanadium Flow Batteries, Specialist Reference Electrodes for Hostile Environments and Smart Flow Battery Technology. Through their collaboration with Nigel Reams, they have designed, developed and piloted system services facilities to address our current need for stabilisation of electricity grids.

Both the EU and Ireland have set ambitious energy and emissions targets for 2020. To meet these ambitions, the majority of Ireland's renewable generation will be provided by wind energy. Wind power is non-synchronous and volatile, requiring the Transmission System Operator (TSO) to limit the instantaneous system non-synchronous penetration (SNSP). Thereby, the TSO ensures that the inertia and system services provided by conventional generation and necessary for grid stability are sufficient. Without system services a disturbance could result in a Rate of Change of Frequency (RoCoF) exceeding the fault ride through capabilities of the remaining synchronous generators, resulting in a cascading loss of generation and potential system collapse.

Over the past number of years, Nathan Quill, Catherine Lenihan, Robert Lynch and Noel Buckley from UL have collaborated with Jake Bracken, Alvaro Fernandez, Frank Burke, Peter Duffy, Nigel Reams, Emmanuel Pican and others to implement a 0.4-MW pilot project, at Rhode, Co. Offaly, that tested both flywheels and batteries. This demonstration plant showed the potential for such facilities to respond rapidly to a sudden fall in frequency following disturbances to the electricity grid. Through such facilities responding rapidly, the fall in frequency can be arrested faster and the frequency nadir reduced, reducing the need for operating conventional generators as backup to the grid.

The planned facilities and investment by the partnership in Co. Offaly are a large-scale fruition of the pilot project. The construction phase will provide 240 jobs and up to 20 people will be employed in the operation of the facilities. Each of the two plants will be around 5,000 square metres in area and eight metres in height, delivering 100 MW of support services with zero particulate pollution or greenhouse gas emissions. Work on construction is expected to begin later this year with completion within one year. Once built, the facilities will support the utilisation of wind and solar energy, mitigating superfluous fossil fuel consumption and reducing our dependence on foreign imports.

*Dr Robert Lynch (2nd from left) at official signing and launch of partnership between Lumcloon Energy (Nigel Reams – 4th from right – and Jake Bracken – 9th from right), Hanwha Energy Corporation (Jo Ho Shin; 2nd from right) and LSIS (Youn Seob Lim; 7th from right) along with members of the collaboration and local and national political representatives*

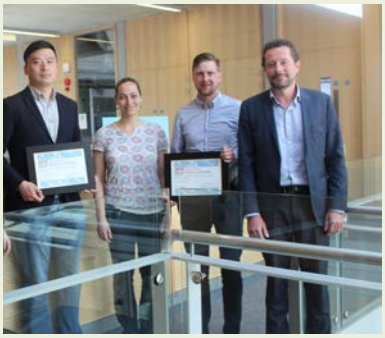
*Dr Robert Lynch at the site of one of the proposed 100-MW facilities along with members of the partnership, between Lumcloon Energy (Nigel Reams, CEO and Managing Director – centre – and Jake Bracken, Project Leader – 5th from right), Hanwha Energy Corporation (Jo Ho Shin; 1st to right from centre) and LSIS (Youn Seob Lim; 2nd to right from centre*

## Math for the Digital Factory

Math for the Digital Factory, which took place from 21st to 23rd March, highlighted the importance of developing an in-depth understanding of the underlying physical mechanisms of manufacturing processes and maximising manufacturing data. There were contributed sessions on topics such as; Math for virtual product development, Modelling Simulation and Optimisation (MSO) of production systems, MSO for material flow problems, Data analysis and modelling, Artificial Intelligence and Manufacturing and Robotics and production machinery. The event featured talks from European Factories of the Future Research Association (EFFRA), Fraunhofer Chalmers Centre for Industrial Mathematics, Siemens AG, and Rusal Aughinish Alumina. The event featured a public discussion on the position of mathematics within the future of digital manufacturing.

## Best Posters at J&J EMEA Engineering Showcase

Feng Xue and Patrick Cronin Post-Doctoral Researchers with Professor Gavin Walker, Bernal Institute, won best poster at the J&J EMEA Engineering Showcase in May. Feng's title was "Modelling fluid dynamics of low/high concentration IgG1 solutions – EI" and Patrick's title was "MOMEnTUM P1 & P2"



## DRS2018 Best of Emerging Irish Design Exhibition


The *DRS2018 Best of Emerging Irish Design Exhibition* presented a range of level 8 design disciplines from creative programmes across Ireland in a capsule exhibition. This is the first time that such an exhibition has taken place in Ireland. The aim of the exhibition is to show-case the creative breadth and calibre of graduate designers in Ireland as well as presenting a diversity of design disciplines available within the country. The exhibition displays 39 pieces of work from 23 creative programmes from 12 institutes. The programme disciplines include; Product Design, Digital Media / New Media, Architecture and interior architecture, Fashion, Ceramics, Graphic Design, Furniture Design, Illustration and Animation.

**Depression Intervention Research:** Dr. Pepijn Van de Ven, ECE Department, is part of a consortium consisting of King's College London, the Universidade de São Paulo and Bristol University, that were successful in acquiring GBP1.1M co-funded by the UK Medical Research Council and FAPESP, the funding body of Brazil's state of São Paulo. The consortium will conduct an innovative depression intervention with a cohort of 24,000 older inhabitants of São Paulo's favelas. Following an initial ICT development phase lead by Dr. Van de Ven and a successful pilot intervention conducted in 2017, Dr. Van de Ven will be responsible for the further development of an extensive ICT system for the support of these depression interventions. In addition to server functionality and web interfaces for various stakeholders, the system contains an Android app that presents the full psychosocial intervention in the form of multi-media resources, tasks for the patient to complete, checklists and medical assessments. Input provided by patients and their care givers is used to automatically adapt the intervention to the particular user. Such adaptation is a key component of any psychosocial intervention and normally creates a requirement for highly skilled providers of the intervention. The core innovation in this project is that the automated and personalised treatment adaptations allow less skilled, and thus less costly, care givers to provide the intervention. Such strategies are known as task shifting and are a core element in solving one of the most important barriers to access to healthcare in low to middle income countries, namely appropriate human resources.

# Grants Awarded

**EPA**: - Trailing the Preparation for Reuse of IT WEEE - €100k. TriReuse will enhance the understanding of how preparation for reuse of consumer waste electrical and electronic equipment can operate in Ireland. It will undertake collection trials targeting critical raw material (CRM) rich products with potential for reuse at retailers, civic amenity sites, and special collection events. Specifically, the project will perform separate collections of flat panel tvs, desktop and laptop computers, tablets and mobile phones where they will be sent for refurbishment. Through this work it will develop operational and logistical understanding of how to optimise separate collection of products with potential for reuse from B2C WEEE from an economic and environmental perspective. It will also support government policy on upscaling preparation for reuse of WEEE at a national level.

**EPA**: - An investigation of WEEE arising and not arising in Ireland - €150k. The EEE2WEEE project will employ qualitative and quantitative methods to provide greater insight into the flow of EEE to WEEE in Ireland. Through a collaboration with Dr Maria Lichrou and Prof Lisa O'Malley of the Kemmy Business School, this work will help to develop an understanding of the flows of B2C and B2B EEE in Ireland and how it makes its way through official channels or otherwise.

**KIC Raw Materials:** Raw Engagement for Electronics Repair - €130k. REFER will raise consciousness of critical raw materials amongst wider society through electronics repair events. The public will attend to have their electronics repaired but in the process will be engaged in discussion and informed about pressing CRM related issues, proposed solutions and how they can help.

**KIC Raw Materials:** Waste Management & Critical Raw Materias – MOOC - €48k. The secondary source of critical raw materials (CRM's) becomes more and more important. Therefore it is necessary for civil servants, especially policy makers, students and manufacturers to learn more about waste management and CRM's.For this a MOOC has been set up as a low threshold approach, followed by a hands-on course, with practical assignments and visits to leading companies in waste management, recycling and remanufacturing.

**KIC Raw Materials: -** E-Mining@School - €56k. This project aims increase awareness among students and society in the raw materials integrated in e-waste focusing on WEEE management, life cycle and related business opportunities by: creating campaigns to engage schools; developing and providing high quality educational materials and a gamification platform; exposing young people to the business opportunity and showing to the wider society the results of these activities.

**IRC Caroline Fellowship** - Behavioural Change for the Circular Economy - €230k. Responsible production and consumption is one of the 17 goals in the United Nation's Agenda 2030, which is essential to achieve sustainable development. Electrical and electronic products have been one of the focus areas in the discussion on resource sustainability mainly due to their growing demand and the use of critical resources. While progress has been made in cleaner and energy efficient processes during the last decades, ensuring more sustainable supply of resources for ongoing technological advancements remains a challenge. Given the nature of the challenge, its solutions mandate a collective effort of businesses, consumers, and governments. This fellowship will address the so far under-explored 'consumption' side of the challenge, and in particular, the role of consumers – arguably the most critical factor in defining the long-term success of 'sustainable production and consumption' initiatives.

**Lero/Kostal:** - Autonomous and remote controlled robotic systems - €435k. These systems are capable of interfacing to and being controlled by a smart MES. This project is in collaboration with Dr Joe Walsh of IT Tralee, Tom Newe and Dan Toal, ECE Department.

# Unlocking the Mysteries of Fundamental Molecular Interactions in Real-time

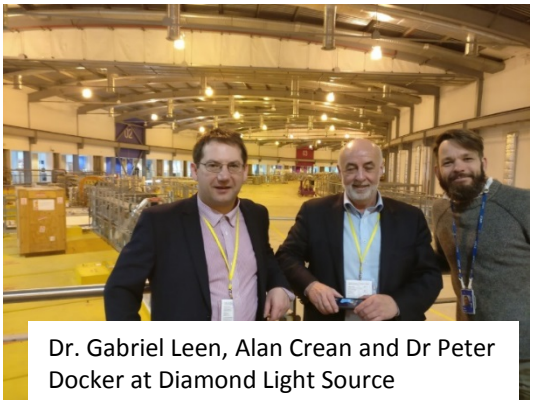
An ECE Senior Research Fellow: Dr. Gabriel Leen and a UL spinout company: PolyPico Technologies Ltd. are participating in various research programs to unlock the mysteries of fundamental molecular interactions in real-time. The research is being led by Prof. Allen Orville, Dr. Pierre Aller and Dr. Peter Docker from Diamond Light Source, which is the UK's national synchrotron facility. The Diamond Light synchrotron is one of the most advanced scientific facilities in the world and accelerates electrons to near light speeds so that they give off light 10 billion times brighter than the sun. This light is then manipulated and used to investigate a variety of materials/processes at a molecular level.

One of the programs of research which Dr. Leen and PolyPico Technologies Ltd. is involved in at Diamond Light Source is to examine turn over in Beta lactamase proteins which is responsible for bacteria developing antibiotic resistance and therefore of significant importance to future world health. The UL Spinout companies technology allows for diffraction data to be collected before and after turnover and consequently enables a deeper understanding of the underling processes. See recent publication: Pico-litre Sample Introduction and Acoustic Levitation Systems for Time Resolved Protein Crystallography Experiments at XFELS. July 2017, Sensors and Transducers 214(7):39-45

Another program of research which Dr. Leen and PolyPico Technologies Ltd. is involved in is to explore a protein known as photosystem II. This protein is responsible for photosynthesis. Until this protein is exposed to light the protein remains in its dark state and the emerging plant seedling shoot grows upwards. When the plant growth brakes through the soil turnover is triggered in the protein by daylight and the plant knows to grow leaves flowers and bud. The PolyPico system will be key in future investigations of this turnover mechanism leading to a greater understanding of the process of photosynthesis. Part of this program of research involved running experiments using the Linac Coherent Light Source (LCLS) at Stanford Linear Accelerator Center (SLAC), Menlo Park, California. SLAC is the longest linear accelerator in the world measuring 3.2 kilometers (2 miles) in length.

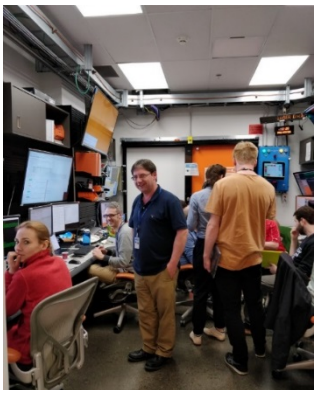
Further programs of research and experiments of various fundamental processes are planned at the European XFEL, which is the world's largest X-ray laser and generates ultrashort X-ray flashes—27 000 times per second with a brilliance that is a billion times higher than that of the best conventional X-ray radiation sources. These experiments will be using the UL spin-out company's technology to introduce extremely precisely timed microscopic pico-litre ($10^{-12}$ of a litre) volumes of material into the x-ray beam line.

Diamond Light Source, Oxfordshire, UK



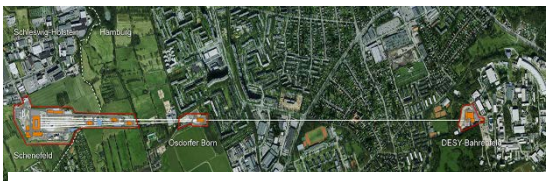
Dr. Gabriel Leen, Alan Crean and Dr Peter Docker at Diamond Light Source

Aerial photo of the Stanford Linear Accelerator Center, with detector complex at the right (east) side.



Dr. Gabriel Leen and some of the research team in a control Hutch at SLAC in May 2018.

Dr. Leen at the Advanced Light Source (ALS), which is a US Department of Energy-funded synchrotron facility at Berkeley Lab California.




Aerial image of the 3.4 kilometer-long EU- XFEL facility in Hamburg Germany.

## SSPC announce new research project with Quater University


SSPC Co-Directors Prof. Mike Zaworotko and Prof Gavin Walker announce new research project with Prof. Majeda Khraisheh of Qatar University, funded by the Qatar National Research Fund (QNRF), which seeks to support research that addresses global grand challenges. The 3 year project on "Trace CO2 Removal for Natural Gas Liquefaction by Advanced Physisorbent Materials" involves the University of Limerick (UL) team undertaking fundamental research on the synthesis and scaled-up manufacture of advanced materials and aims to use them to develop a disruptive new technology for carbon capture. The materials prepared at UL will be applied in pilot scale facilities in Qatar. Prof. Khraisheh says that "working with a world class team at UL will accelerate the development of these novel materials, which aims to have impact on a global scale."

## "Selected Topics in Mixed-signal IC design"

The Circuits & Systems Research Centre (CSRC) hosted a 2-day short-course on "Selected Topics in Mixed-signal IC design" by Prof. Klaas Bult (TU Delft) at the University of Limerick 14th & 15th June. The main topics this year are power efficient, high performance data converters in System-on-Chip/Embedded environments.

Prof. Klaas Bult has a distinguished career in IC electronics with placements at Philips Research Labs, Twente University and as a director with Broadcom responsible for Analog and RF circuits for embedded applications. He is now an independent consultant in Analog IC design operating from the Netherlands. Klaas Bult is an author of more than 60 international publications and holds more than 60 issued US patents. He is a Broadcom and IEEE Fellow.

Two guest lectures were also organized for each day.

Guest Lecture (Arralis) - "FMCW Radar Design for Autonomous Vehicle – Mr. Yulung Tang (Senior MMIC design engineer at Arralis)

Guest Lecture (Jaguar Land Rover) - "Overview Automated Driving Systems" – Mr. Peter Barry (Chief software architect autonomous driving at JLR)

## Invited Talk

Dr Liam Peyton, PhD, PEng, a software engineering professor in the School of Electrical Engineering and Computer Science a the University of Ottawa, Canada, gave an invited talk in Lero on 17th April. The title of his talk was 'Engineering healthcare Performance Management: Transforming Care Processes in a Complex Data World'. We live in a rapidly changing, information-intensive world that presents both challenges and opportunities for improving healthcare. Our research in software engineering and health informatics focuses on leveraging emerging information technology to enable performance management of value-based improvements in quality of care. Our approach consists of establishing business process and performance management models of care in a continuously integrated data architecture within the context of organizational and societal transformation. The technology leveraged includes cloud computing, enterprise BPM, lightweight mobile performance monitoring apps, and process mining. Our presentation will draw on examples from our collaboration with hospitals and community organizations in Toronto and Ottawa, Canada as well as the Intromat project in Norway.

# ReNu2Farm Launched

On Friday, 22nd June, Institute of Technology Carlow joined forces with University of Limerick and Cork Institute of Technology to start the Irish arm of the major European project in soil nutrient sustainability – ReNu2Farm, part funded by Interreg North-West Europe. The European funded project seeks to replace conventional mineral fertilisers with recycling-derived equivalents. Institute of Technology Carlow hosted the national launch event that was opened by the Institute of Technology Carlow President, Dr Patricia Mulcahy, and was prefaced with a keynote talk from Dr Mark Healy of the GENE Group, NUI Galway. Over 60 stakeholders were present from various research organisations, representatives from the fertiliser waste management and agricultural industries, as well as farmers. ReNu2Farm will work closely with associated partners Teagasc, the Southern Waste Region Management Office, the IFA and the larger farming community as part of the project.

ReNu2Farm comprises 10 partners from higher education organisations, research institutes and industry that will work to address the global threat posed to industrial agriculture by the vast depletion of the essential macronutrients nitrogen, phosphorus, and potassium (N, P, K), without which plants cannot survive. The future of agriculture – and food supplies – necessitates nutrient recycling or composting on a global scale. The ReNu2Farm project will map regions in North-West Europe with both nutrient shortage and surplus with the aim of exchanging recycled nutrients across the regions and foster producer-consumer collaborations. Farmers' needs will be surveyed during the project and the results used to tailor and develop recycling-derived fertilisers between nutrient surplus and demand regions. The undertaking will help in establishing transnational markets, informing national and EU policy and market barrier reduction. The overall expected outcome by the end of the project will be the replacement of conventional mineral NPK fertilisers by recycling-derived fertilisers.


*The ReNu2Farm Irish team (LtoR) Dr Joe Harrington (Head of School, School of Building and Civil Engineering, Cork Institute of Technology), Dr Patrick Forrestal (Teagasc, Johnstown Castle, Wexford), Dr Vesna Jaksic (Department of Civil, Structural and Environmental Engineering, Cork Institute of Technology), Mr Peter Linden (IFA, Smart Farming Programme), Dr Thomaé Kakouli-Duarte (enviroCORE, Department of Science and Health, Institute of Technology Carlow), Ms Sarah O'Brien (Research and Commercialisation Support Centre, Institute of Technology Carlow), Dr Achim Schmalenberger (Department of Biological Sciences, University of Limerick), Dr Kieran Germaine (enviroCORE, Department of Science and Health, Institute of Technology Carlow), Dr David Dowling (enviroCORE and Head of Faculty of Science, Institute of Technology Carlow).*

# EMRA 2018

A workshop on EU-Funded Marine Robotics and Applications (EMRA) 2018 took place on June 12-13th 2018 at the University of Limerick. The 5th edition of the workshop was organised by Centre for Robotics & Intelligent Systems (CRIS) under the H2020 projects EXCELLABUST and SWARMS. EMRA '18 summarised current EU FP7 and H2020 projects on marine robotics and provided a platform for marine stakeholders to share and discuss current technological challenges and achievements. EMRA '18 provided a great opportunity for researchers to disseminate current work and highlight new application areas that warrant further R&D opportunities, while it also gave marine stakeholders a chance to cross-fertilise the ideas and offer novel approaches to meet future challenges in ocean exploration and exploitation.

In parallel to the EMRA workshop, the SWARMs (Smart and Networking Underwater Robots in Cooperation Meshes) project consortium organised the **"Conference on Novel Solutions for Underwater Vehicles in Autonomous Sea Operations"** on **11th June**. The conference was co-hosted by the Centre for Robotics & Intelligent Systems.
The primary objective of the SWARMs project was to expand the use of underwater and surface vehicles (AUVs, ROVs, USVs) to facilitate the conception, planning and execution of maritime and offshore operations and missions. The conference topics included: development methodologies and novel designs for autonomous maritime missions, data modelling for underwater robotics vehicles, new solutions for sensors and processing algorithms for underwater environments, data processing, 3D mapping, landmark extraction, map matching, relocation, etc.

# Engineering Workshop

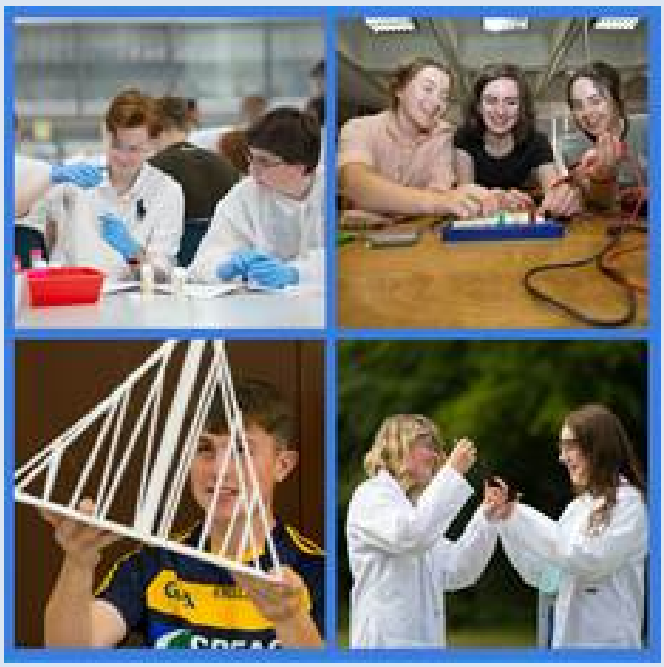
Through a joint initiative between ECE Dept. and Analog Devices, Dr Sinéad O'Keeffe (ECE) and Dr Charusluk Viphavakit (ECE) and Margaret Naughton (Analog Devices) recently visited Ballinahinch National School, Co. Tipperary to deliver an Engineering Workshop to over 130 pupils, from Junior Infants to 6th Class. The workshop was due to be delivered as part of Engineers Week but was postponed due to the snow. Each class had a 90 minute workshop, specially tailored to their ages, aimed at raising awareness of the different engineering areas, the impact of engineering in society and challenging the stereotypical image of an engineer. The workshop involved a 20 minute talk about Engineering, highlighting the ongoing sensors research in ECE and the activities at Analog Devices. This was followed by a hands-on workshop, where each class was divided into 5 different engineering areas (civil, mechanical, aeronautical, biomedical and electronic). They were further broken up into teams to compete against each other in tasks relating to their engineering discipline.

Dr Sinéad O'Keeffe (ECE) and Dr Charusluk Viphavakit (ECE) with 5th & 6th Class, Ballinahinch NS

Dr Sinéad O'Keeffe (ECE) showing 5th Class "Electronic Engineers" how to make bristlebots

3rd Class "Biomedical Engineers" with the prosthetic hand they made.

# Science & Engineering Summer Camp



Students from Kildare, Laois, Galway, Waterford, Kerry, Cork, Tipperary, Limerick and Clare attended the UL Science and Engineering Summer Camp on 25th and 26th June. It was all go in an action packed two-day camp designed to enable students to use a 'practical' approach to investigating the different aspects of science, technology engineering and mathematics. They got to use a life-size wind tunnel for the evaluation of aerodynamic efficiency of planes, design and build their own bridge, explore the world of chemistry and cool things down with ice-cream that they made themselves and engaged in a set of food and nutrition issues relating to adolescent health. Micro-organisms, lichens, plants and freshwater organism were identified in the ecology session while the participants also got to design and launch their own rockets, make a heart monitor by building a circuit board, generate electricity by building their own electric generator and explore how wind, water and sunlight can be harnessed to produce power.

In addition throughout the two days, participants were able to explore and tease out the questions they had on different aspects of the academic programmes and the career opportunities open to graduates of these programmes. The two day camp was a huge success and participants left with a better understanding of both the science and engineering disciplines.

# Electron Crystallography School


Dr Andy Stewart (Department of Physics) was director of the international school of crystallography 51st course: Electron crystallography, from the 1-10th of June 2018. The school was held in Erice Italy at the Ettore Majorana Foundation and Centre for Scientific Culture named after the Sicilian prodigy Ettore Majorana who was a successful student of Enrico Fermi's and vanished without trace not long after he started teaching at the University of Bologna.

The International school of crystallography is held yearly since 1974 and was founded by Dorothy Hodgkin and in later years run by a member of her group who helped determine the structure of Insulin, Sir Tom Blundell.

This school has a long and distinguished tradition with several Nobel prize winners and notable luminaries in various branches of crystallography having been trained and mentored at the school. This years course taught the students the fundamentals of electron crystallography and structure determination from nano-crystals using electron diffraction. This technique can be used to determine a wide range of crystal types form inorganic crystals through to protein structures. The course participants consisted of 57 PhD students and young postdocs, and 19 lecturers and workshop leaders, all lectures are recorded for the students to be able to go back and refresh there understanding in years to come, most lectures were coupled with effective hands-on sessions. The participants themselves were encouraged to show their recent work during the poster sessions. There were two poster sessions in the evenings, exhibiting half of the posters in each session, with a chance to preview the poster during lunchtime. Many discussions were held at the poster during both the "official" poster sessions and the preview sessions. The three best posters were selected by a small committee, and the creators of those posters were presented with a certificate at the end of the course. Networking was supported by several organised social events.

Two excursions were held during the school one afternoon to Mozia and the other to Selinunte and Segesta temples.

Erice is an ancient town with a rich history, which sits on a mountaintop in Sicily and has some remarkable views, as can be seen from the picture of the view from the lecture theatre coffee room.

We also have a remarkable group of "orange scarf" helpers who assist with nearly all aspects of running the school, including Dr Matteo Lusi from the Department of Chemical Sciences.

Future schools see http://crystalerice.org

# Engineering Ambassadors programme

The School of Engineering in UL applied in November 2017 for a Bronze Athena SWAN Award, as part of the process it became apparent that one reason for the low numbers of women in engineering is due to lack of role models for secondary school students. This lead to Dr. Reena Cole (School of Engineering Athena SWAN Champion) establishing an Engineering Ambassadors programme, where current students return to their secondary school to talk about studying Engineering. There are currently 32 Ambassadors, in 1st year (General Eng and Aeronautical Eng) and 2nd-3rd year (Aeronautical, Biomedical and Mechanical Eng), and their schools range from Cork-Mayo/Sligo and east to Dublin/Wexford.

http://www3.ul.ie/courses/Engineering.php

## Lero & Scratch


Lero hosted the national finals of the Scratch competition for primary and secondary school children in April during TechWeek. It was a fantastic day with 32 finalists presenting their projects. These 32 projects were selected from over 500 entries. Lero was delighted to have Dr. Norah Patten as keynote speaker.

## Collaboration as Gaeilge

Lero member Yvonne Delaney designed a 2-day workshop programme on Interview, Communication and IT skills for 60 transition year students from Gael Choláiste Luimnigh. This workshop was a collaboration between KBS and Lero. Students visited UL in April and participated in workshops to develop their interview and communication skills. The session also included a presentation on opportunities in technology. The students returned in May to present to their peers and the UL workshop team. Feedback from teachers and students was very positive.

## Romanian Electronic and Computer Design Contest

For the sixteenth consecutive year a team from UL has set the contest task and led the international jury of the 'Hard and Soft' contest, held annually at the Stefan cel Mare University of Suceava. The contest, in which teams of four must design and build a fully functioning system comprising electronic hardware and software components in four days, attracts students from university teams from Romania and other Central European countries, Germany and from as far away as China and is in its 25th year.

The Jury, led by UL's Tim Hall, included academics from the University of Lille 1 in France, Dr Ciaran MacNamee of Department of Electronic and Computer Engineering at UL, and engineers from ServicExpert, the system and software house for manufacturers of commercial vehicles and the supplier industry in Germany and Europe.

The 2018 contest task, set by Jury president Professor Tim Hall, was to build a 'no moving parts' portable weather station, capable of acquiring and storing weather data, including wind speed and direction and rainfall measurement readings, was a modern Internet of Things take on the first task set by Tim Hall in 2003, the first year of UL involvement in the contest.

Commenting on the many years of collaboration with the Stefan cel Mare University of Suceava, Tim Hall said, 'The University of Limerick has a proud tradition of international collaboration, and our involvement with the University of Suceava through many EU programs and the Hard and Soft contest, is a great example of cooperation and has been beneficial for all concerned. We hope that it continues for a long time to come.' For more details, see http://www.hardandsoft.ro .

## UL SIAM Student Modelling Week

The **UL SIAM student modelling week** took place June 5th to 8th in the Charles Parsons theatre. The student organised events provides undergraduate and early stage PhD students with experience in solving real-world problems. Local and visitor problem leaders included Prof Mark McGuinness, Dr Vincent Cregan, Dr Kevin Burke,
Dr Rosemary Dyson and Prof William Lee

The titles of the projects were

- Calibration of a Moisture Analyser (Rusal Aughinish Alumina Ltd.)
- Energy Demand Forecasting (Vayu)
- Aeration Optimisation for Hydroponics (Phytoponics Ltd.)
- Modelling an Electrostatic Potential (Company A)

## Shannon Archaeological and Historical Society

On Wednesday 21 March 2018, Dr. Anna Ryan gave an invited lecture to the Shannon Archaeological and Historical Society as part of their Winter Lecture Series, at the Oakwood Arms Hotel, Shannon. This lecture was titled Into the West: Rineanna and the Jumbo Jet, and was based on her research on Shannon Airport for Ireland's Pavilion at the 2014 Venice Biennale of Architecture, curated by Gary A. Boyd and John McLaughlin. Titled Infra-Éireann: Making Ireland Modern, the exhibition and book focused on the building of the Irish nation through ten infrastructural episodes, focusing on one infrastructure that was particularly significant for each decade across a period of a hundred years from 1914-2014. Anna's work formed one chapter of the book and one episode of this exhibition. Her research considered Shannon Airport from its inception to the present day, in particular focusing on the decade between 1964 and 1974. It emerged from archival research, and presented exciting new material from a range of archives, including Shannon Development, The Office of Public Works, The Irish Architectural Archive, The National Archives of Ireland, the National Library of Ireland, the National Photographic Archive and The Special Collections Library at University of Limerick. The lecture was very well received by a very passionate and engaged audience of over 60 local people in attendance, with a lively questions and answers session at the end. Earlier that day, Anna was interviewed about her research by Gavin Grace of Morning Focus on Clare FM. The podcast of the interview is available at:
https://soundcloud.com/clarefm/dr-anna-ryan-on-the-into-to-the-west-rineanna-and-the-jumbo-jet-talk

The research essay in pre-published final form minus the images is available on the UL Institutional Repository:
https://ulir.ul.ie/handle/10344/4709

The full research book Infra Éireann: Making Ireland Modern is available at:
https://www.routledge.com/Infrastructure-and-the-Architectures-of-Modernity-in-Ireland-1916-2016/Boyd-McLaughlin/p/book/9781472446862

The website of the overall Infra Éireann Making Ireland Modern project is available at:
http://makingirelandmodern.ie/

## European Women in Mathematics

Dr. Romina Gaburro (M&S, UL) has been recently appointed as the National coordinator for Ireland by the European Women in Mathematics (EWM). EWM is an international association of women working in the field of mathematics in Europe. It was founded in 1986, aiming at encouraging women to study mathematics; supporting women in their careers; providing a meeting place for like-minded people; promoting scientific communication; cooperating with organizations with similar goals; gathering and providing information on women in mathematics; giving prominence and visibility to women mathematicians; spreading their vision of mathematics and science.
EWM has several hundred members and coordinators in 33 European countries. Every other year, EWM holds a general meeting and a summer school. The next general meeting will be held in Graz, Austria in September 2018. A newsletter is published by EWM at least twice a year. EWM has a website, a Facebook group and an e-mail network.

Dr. Gaburro, who has been invited to take part to the panel discussion at the *Women in Mathematics Day Ireland* (University College Dublin, August 2018), explains that anybody with an interest in mathematics can apply to become a member of the EWM. It provides a great platform to connect with other (mainly female) mathematicians in Europe and share information about upcoming events, conferences, academic positions and scientific collaboration within Europe.

## Chair of the NSAI Technical Committee 22

Dr. Colin Fitzpatrick has been elected Chair of the National Standards Authority of Ireland (NSAI) Technical Committee 22 on "Environmental Standardization for Electrical and Electronic Products and Systems". This is a three year term and will the mirror the activities of the corresponding CENELEC and IEC Technical Committees with representation from Irish industry.

Jakki Cooney pictured recently at Áras an Uachtaráin with President Michael D. Higgins and his wife Sabina Higgins celebrating female entrepreneurship. Jakki is a Senior Lecturer in the Department of Biological Sciences and co-founder of Cala Medical

## Electricity Exchange

Congratulations to Dr Paddy Finn (ECE alumnus) on the official opening of the new Electricity Exchange offices in Plassey Technology Park on June 15th. Electricity Exchange goes from strength to strength and plans to expand its workforce from 24 to 50 within the next 12 months. Paddy was also a finalist in the EY Entrepreneur of the Year 2018 Awards. Electricity Exchange is capable of remotely reducing electricity demand on the sites of hundreds of large electricity consumers, either by turning on existing back-up generators or by shutting down non-essential processes for short periods, to make their power available to other users on the electricity system. This achieves the same net effect as a conventional power station and currently it can provide the Irish electricity market with as much power as the Ardnacrusha hydroelectric power plant.

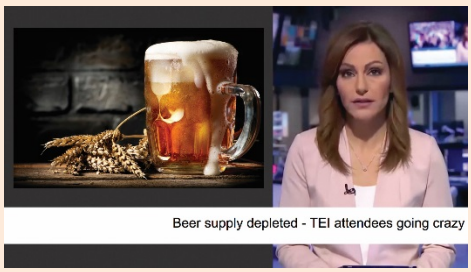
## Knowledge Transfer Ireland Consultancy Impact Award

The Knowledge Transfer Ireland Consultancy Impact Award was won by MACSI in 2018, for the second year in a row, on Thursday 26th April in Royal Hospital Kilmainham Dublin. MACSI worked with Xtract an Irish start-up that has developed a connected claims platform for all Internet of Things (IoT) crash data. MACSI provided Xtract with the mathematical and statistical tools to aggregate and visualise data for motor claims handlers at the moment of impact which empowers them to determine liability, deflect fraud and automate vehicle damage triage. The physical model detects impacts using GPS and accelerometer data recorded prior to and during an accident and identifies the time and force of an impact, the physical point of impact on the vehicle and provides an estimation of the trajectory taken by the vehicle and aspects of the driving itself. The research team worked closely with Xtract's software team to ensure seamless implementation of the mathematical model into the Xtract software. The company now aims to further scale business development across Europe and the US, armed with a robust, production ready model for the motor claims industry. The MACSI team was led by Kevin Brosnan, working alongside Dr. David O'Sullivan, Dr. Kevin Burke and Dr. Sinéad Burke. A short video on the project is available here https://www.youtube.com/watch?v=ZTEdpN_PCTo

## Tangible Embodied Interactions Conference

The theme for the 2018 Tangible Embodied Interactions Conference (TEI) was the 'post-digital'. A call was made for artworks (to be displayed in the Kulturhuset Gallery Stockholm) that address technology in terms of its ability to provoke and create rather than simply serve and function.

Entitled 'LetsFakeNews', Dr Léon McCarthy's, Department of Computer Science and Information Systems, artwork was an ironic effort to encourage visitors to question the creation and consumption of fake-news.
He projected what looked like a real Al Jazeera TV News Cycle into the gallery, but it was anything but real. Visitors used his web-app on their phones to write short fake-news stories, the text of which was then mined for meaning with imagery fetched in real-time from the web to match the meaning of each phrase in the story. The combination of subtitles, images and video presented by the Al Jazeera news-anchor on-screen created a disturbingly entertaining spectacle.
Due to the impact the artwork had at TEI, it has since been selected to appear in an upcoming edition of ACM's international 'Interactions' magazine.

## Seismic And Radar Imaging Algorithms

Dr. Romina Gaburro and Dr. Cliff Nolan recently (June, 2018) visited the American Institute of Mathematics (AIM) in San Jose, California, where they are developing imaging algorithms for radar and seismology in collaboration with colleagues from the University of Rochester, Rochester Institute of Technology and Colorado State University. The group has been awarded a SQuaREs (Structured Research Quartet Ensembles) grant by AIM to establish the mathematical foundations of imaging techniques used in Earth exploration. This will be used to improve the way we image both the surface and the subsurface of the Earth.

From L to R: Dr. Romina Gaburro (M&S, UL), Prof. Raluca Felea (Rochester Institute of Technology), Prof. Allan Greenleaf (University of Rochester), Dr. Cliff Nolan (M&S, UL) and Prof. Brian Conrey (Director of AIM).

The two UL-based mathematicians explain that traditional imaging methods produce undesirable artifacts in images and that their recent work at AIM on Doppler Synthetic Aperture Radar (DSAR) shows how such artifacts may be eliminated by collecting narrow-band (single-frequency) data and applying a specially-designed filter to this radar signal before processing this data to form the final image. Dr. Nolan recently presented this work at a Workshop in Microlocal Analysis at the Turing Institute in London, where it generated a lot of interest from the UK radar community. As a result of discussions at this workshop, the DSAR method will be tested out on real data. The group expects to see a significant improvement in the images of the Earth's terrain produced by DSAR compared to the application of other imaging techniques. There are numerous applications of DSAR, including monitoring the health of forests, helping to locate earth-quake victims, etc.

Part of this work has been also carried out in UL during a visit of Prof. Allan Greenleaf (University of Rochester) to the Department of Mathematics and Statistics (M&S) in March, 2018. This visit was supported by the International Visitor Programme of M&S and the International Activity Challenge Fund 2017.

## Effects of Nutritional Profiles on Pregnancy

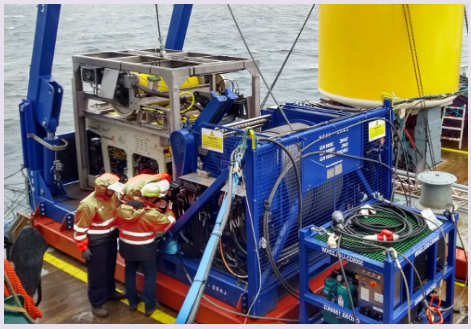
Research indicates that our health and the health of our children may be influenced by nutritional factors. One important factor seems to be the essential trace element zinc. Therefore, the Cellular Neurobiology & Neuro-Nanotechnology lab of the Department of Biological Sciences at University of Limerick has launched a nationwide study to investigate effects of nutritional profiles on pregnancy. Research participants can be females in Ireland with one or more children, who lived during their pregnancy in Ireland. The study procedures involve completing a Food Frequency Questionnaire. You can download the questionnaire at: http://www.cellular-neurobiology.ie/Cellular-neurobiology/Questionnaire.html.

The major goals of the study are to understand how common low levels of zinc intake in women and pregnant women in Ireland are, and whether low zinc intake is associated with a greater risk to develop neurodevelopmental disorders. For further information contact, Dr. Andreas Grabrucker (**andreas.grabrucker@ul.ie**)

## Inflammation, not Cholesterol, Is a Cause of Chronic Disease

Since the Seven Countries Study, dietary cholesterol and the levels of serum cholesterol in relation to the development of chronic diseases have been somewhat demonised. However, the principles of the Mediterranean diet and relevant data linked to the examples of people living in the five blue zones demonstrate that the key to longevity and the prevention of chronic disease development is not the reduction of dietary or serum cholesterol but the control of systemic inflammation. In this review, we present all the relevant data that supports the view that it is inflammation induced by several factors, such as platelet-activating factor (PAF), that leads to the onset of cardiovascular diseases (CVD) rather than serum cholesterol. The key to reducing the incidence of CVD is to control the activities of PAF and other inflammatory mediators via diet, exercise, and healthy lifestyle choices. The relevant studies and data supporting these views are discussed in this review. Tsoupras, A.; Lordan, R.; Zabetakis, I (Dept of Biological Sciences). Inflammation, not Cholesterol, Is a Cause of Chronic Disease. *Nutrients* **2018**, *10*, 604 http://www.mdpi.com/2072-6643/10/5/604

# CRIS Launches Robot For Use In Marine Renewable Energy Sector



The Centre for Robotics & Intelligent Systems (CRIS) unveiled a unique €2-million underwater robot at the docks in Limerick city on Monday 23rd April. The Remotely Operated Vehicle (ROV) was officially launched by Minister of State for Trade, Employment, Business, EU Digital Single Market and Data Protection, Pat Breen TD. The Science Foundation Ireland (SFI) funded ROV Étaín can operate in challenging wind, wave, and tidal conditions and will be used to inspect, repair and maintain Marine Renewable Energy (MRE) facilities. Speaking at the launch, Minister of State Pat Breen said: "Internationally, the offshore renewable energy sector is set to rapidly grow which will help to reduce carbon emissions and arrest climate change. Ireland has the best wind and wave resources in Europe and it is vital that as an island nation we invest and engage in research in the area of marine energy technology. Therefore, I'm delighted to today launch this ROV which will support Ireland's growing offshore renewable energy sector."

Researchers at UL's Centre for Robotics & Intelligence Systems (CRIS) have enhanced a commercially available ROV system (Forum Energy Technology's Comanche ROV) with UL-developed advanced control software (OceanRings), precision navigation and flight control, state-of-the-art robotic imaging and sonar systems and fully automated manipulator systems. These advanced features allow the robot to operate in the challenging environment of ocean renewable energy to support inspection, repair and maintenance operations. Professor Daniel Toal, Director of the Centre for Robotics & Intelligence Systems at UL, explained: "Operation support in the MRE sector usually occurs on floating infrastructures so conditions are regularly beyond the capability and operating limits of commercial ROV technology. This means new smart ROV systems capability is necessary and that is what our team at UL has developed and launched today."

UL's Centre for Robotics and Intelligence Systems is part of the University College Cork led SFI national Centre for Marine and Renewable Energy Ireland (MaREI). The MaREI robotics lab at UL leads operations support engineering projects with industry partners such as Shannon Foynes Port Company, ESB, Ireland's National Space Centre, SonarSim, Teledyne, Resolve Marine, CIL, IDS Monitoring and among others.
"The advanced robotics technology developed at UL will be crucial in supporting the burgeoning marine renewable energy sector. It will also play a significant role in reducing the cost of installing and maintaining large-scale offshore energy generation infrastructure. As the worldwide marine renewable energy sector grows, UL's research contribution in this area will have even greater impact. I am particularly happy to see this advanced UL technology being developed, trialled and launched in Limerick City docks. The UL robotics base at the docks is just one of our commitments to grow and maintain strong links between the campus and the heart of Limerick city, with strategic partners like Shannon Foynes Port Company," University of Limerick President, Dr Des Fitzgerald, stated.

# Master Class in Process Safety

A 1-day Masterclass in Chemical Process Safety hosted by the Department of Chemical Sciences, UL and SSPC was delivered by recognised experts in the field of process safety including. Mark Gallagher who has worked in international motorsport for over 30 years, including senior roles with the Jordan, Red Bull Racing and Cosworth's Formula One™ teams. Sally Martin, Vice President of Health, Safety, Security and Environment (HSSE) for global downstream and manufacturing operations at Shell. Ian Travers, a world expert on process safety management, leadership and the establishment and implementation of key performance indicators for major hazard industries.

# Launch of the Bernal Bio Laboratories

On May 23rd UL presented an honorary doctorate to Professor Robert Langer, creator of a life saving method of drug delivery. Sometimes referred to as a "pharmacy on a chip", this ingenious system for controlling drug release was the first to use biodegradable polymers to implant medicines within the body; as the polymers broke down, the medicines were released exactly where and when they were needed. Using ultrasound, electric pulses and magnetic fields, Langer refined the method so that implanted drugs can be released over a period of weeks, or even months. It is estimated that Robert Langer's research and inventions have improved the lives of 4.7 billion people. Professor Langer officially opened the Bernal Bio Laboratories during his visit and he commented that "these new laboratories present a great opportunity for UL researchers to continue their cutting-edge work in the areas of bioengineering and bioprocessing in a state-of-the-art environment"

# Inaugural Lectures

Prof Luuk van der Wielen, Bernal Chair of Biosystems Engineering and Design and Director of the Bernal Institute. Title of talk: 'Biosystems Engineering and Design for a BED-er healthy World.

Prof Paul Weaver, Bernal Chair of Composite Structures and Materials. Title of talk: 'Planes NOT trains and automobiles, what composite structures can do for you'.

Prof. Tiziana Margaria, Prof. of Software Systems. Title of talk: 'IT's the lace that counts! A thread that empowers everyone.

# Talking to my Father

*Robin Walker with his son, Simon Walker*

Talking to my Father, funded by the Arts Council Reel Art scheme and directed by Sé Merry Doyle, is a narrative through the life and architecture of Robin Walker, one of the most celebrated and intriguing figures of modern architecture in Ireland. The documentary was screened on RTE 1 on 29th May. SAUL lecturer Simon Walker, Robin's son, revisits his father's buildings, reflecting on the architecture in Ireland during the modernist period. This conversation between Simon and his father's work, complemented by Patrick Jordan's beautiful and sensitive cinematography, unravels the compelling story of Robin Walker. Having worked for le Corbusier in Paris as a young graduate, he later studied under Mies van der Rohe in Chicago, and in 1958 returned to Ireland to become an influential and prominent Irish architect as partner in Scott Tallon Walker. In the exploration of his father's most iconic buildings, Simon deliberates the period's cultural optimism and civic idealism, which was prematurely halted in the oil crisis of the early 70s. This saw Robin Walker withdrawing from architecture and family. A quarter of a century after Robin's death – set against the wild environs of the Beara Peninsula in 'Bóthar Buí', the home Robin built for his family – Simon talks to his father again and considers the legacy of his architecture and its place in today's Irish architectural context. *The film premiered at the Jameson Dublin International Film Festival in March 2015, followed by screenings at Open House Cork, The Irish Film Institute, New York Architecture & Design Film Festival and in 2016 it was screened in Winnipeg, Regina and Saskatoon as part of the Canadian Architecture+Film series.*

# Three UL Architecture Graduates Shortlisted For Prestigious Awards

Three thesis projects by UL architecture graduates were shortlisted in two high-profile European awards competitions, recognising innovation and originality in projects that demonstrate societal responsibility and professional execution alongside conceptual freedom inherent in student work.

UL alumni Maeve Curley and Sean William Murphy who graduated in 2017 have been shortlisted for the prestigious Young Talent Architecture Award (YTAA). The award is organised by the Fundació Mies van der Rohe (Barcelona) with the support of Creative Europe as an extension of the European Union Prize for Contemporary Architecture – Mies van der Rohe Award. YTAA brings together the best graduation projects from European architecture, urban planning and landscape schools, this years joined for the first time by schools from China and South Korea. Over 450 students from 118 schools around the world submitted 334 projects of which 40 were selected to compete for the YTAA's second edition since 2016. All shortlisted projects are on display at the European Cultural Centre in the Palazzo Mora in Venice to coincide with the Architecture Biennale 2018. The exhibition will travel to architecture schools throughout Europe. https://www.ytaaward.com

Maeve Curley designed a layer of sporting infrastructure built on top of Limerick's Georgian grid. Committed to the idea of 'giving back,' her thesis "Civic Games" proposed to hold Olympic Games that work at the scale of the city, and its arenas become civic spaces after the games. http://ytaa.miesbcn.com/work/372

In his thesis project "Benevolent Scarring," Sean William Murphy designed a new maternity hospital for Limerick that engages sensibly with the surrounding urban fabric of a former working class neighbourhood. His proposal brings a maternity hospital back to its very nature, back to the domestic and human scale.
http://ytaa.miesbcn.com/work/373 Sean's thesis project also received an Honourable Mention in the European Architectural Medals for the Best Diploma Projects (EAM BDP) 2017.
https://eam.uauim.ro/projects/2017/60/

This is an annual European competition that awards excellence in crossing the threshold from education to profession. This year, 156 projects from 29 countries entered the competition. The organizers, University of Architecture and Urbanism Ion Mincu (UAUIM) together with European Association for Architectural Education (EAAE) and (Architects' Council of Europe) ACE seek to recognize the highest level of design knowledge and skill employed in addressing crucial themes of architectural design: approach to problem solving, social and environmental awareness, and innovative response and originality. https://eam.uauim.ro

Another SAUL thesis project was shortlisted in the same award: The intention of the thesis "Industry in the City – The Noise from the Back Yard" by Rico Strinati was to facilitate a need to expand local industries into the wider context of the city and to encourage collaboration between members of neglected neighbourhoods. The program was inserted into the narrow space between the productive backyards of ordinary terraced houses and the formidable masonry walls of the former Taits clothing factory in Limerick.
https://eam.uauim.ro/projects2017/15/

Images: Architecture thesis projects by Maeve Curley, Sean Murphy and Rico Strinati

## Study Trip to Portugal

For one week at the beginning of the Spring semester of 2018, Unit 2 in Design Studio Y2 and Y3 went on a field trip to Lisbon in Portugal to research the conditions for urban life in Lisbon and its environs - density, climate, property, participation, typology - that support and enhance human lives in this city. Particular emphasis this semester was given to the lives of senior citizens.

We walked, discussed and sketched Lisbon and its environs to understand the city's growth, history and changing urban morphology. We studied both old and new communities focusing on housing as well as public buildings and places of learning. We were concerned with looking closely at a number of buildings and contexts in Lisbon. Each day we walked a different area of the city taking in at least one public building, a market and a housing scheme. We observed the fabric, grain and material culture of the city. We absorbed the climate of the city in order to understand how this affects its architecture. We also experienced the terrain and geography of the city.

Our ambition was not to encourage students to copy work on their return to SAUL. Instead we proposed that students use Lisbon as a living resource for design project work later in the semester in order to produce new knowledge and new ways of looking about housing and public space. The choice of an unfamiliar context and of a perhaps unfamiliar tradition ultimately helped the students to reflect more generally on urban conditions and to invent new models of wider relevance for urban life.

## Software for the Future

Software is the invisible glue that runs the systems we all depend on for our daily lives. As such we need to be concerned with how it is designed, built and deployed. To debate this and other major issue facing future software research, Lero hosted an industry event on the 26th June. Representatives from SME's and multi nationals joined us on the day to participate in the workshops and talks. The keynote address was given by Danese Copper, Head of Open Source Software at Paypal, Inc. on 'Plate Tectonics in the Software Industry'.

## €14.5 million SFI research programme, ENABLE


*( L to R: Prof Mark Ferguson, Science Foundation Ireland, Minister for Business, Enterprise and Innovation, Heather Humphreys, T.D Prof Siobhan Clarke, Lero)*

Minister for Business, Enterprise and Innovation, Heather Humphreys, T.D., together with Minister of State for Training, Skills, Research, and Development, John Halligan, T.D., have launched ENABLE – a new €14.5 million Science Foundation Ireland research programme which will examine how the Internet of Things can be used to improve the quality of life for ordinary citizens living in urban environments.

ENABLE's academic researchers will work in partnership with over 25 companies including large multinationals such as Intel and Huawei, and SMEs such as Cork-based Accuflow. The ENABLE research programme will address a wide range of topics including water management, air pollution, transport congestion, data privacy and cyber security. It will receive €10 million from Science Foundation Ireland and a further €4.5 million through collaborative research agreements with industry partners.

ENABLE will be led by Professor Siobhán Clarke at Trinity College Dublin and will include 60 researchers in three existing Science Foundation Ireland Research Centres - CONNECT, Insight and Lero. The researchers will be based in Trinity College Dublin, Dublin City University, Cork Institute of Technology, Maynooth University, NUI Galway, University College Cork and University of Limerick.

## SAUL Y1 Study trip to Dublin

**February 26 – 28 2018**

On 26 and 27 February, the study trip took SAUL first-year architecture students to Dublin. On the first day, the students studied the articulation of architectural elements – doorways, window seats, flights of stairs – in historic and modern buildings, using buildings on the Trinity campus as their examples: the Long Room and Berkeley libraries, the Museum Building, and the Douglas Hyde Gallery. After visiting the East Wall neighbourhood and local community centre, the second day focused on a comparative study of two small-scale residential developments, a house conversion and a mews house. With the current owners and residents generously granting access and answering questions, the architects of each project explained their design ideas in detail. On the planned third day, unexpected heavy snowfall cut the study trip short.

First-year architecture students sketching in a Dublin residential neighbourhood

## SAUL Y2/Y3 (Unit 2) Study Trip to Morocco

**January 28 to February 4 2018**

Y2 & Y3 students went on study trip to Morocco, first to the cities of Fez and Meknes where they visited and studies traditional North African building typologies such as Madrasas (World first universities), Daar (traditional houses), as well as traditional urban city forms in the UNESCO world heritage Medina of Fez & Meknes. The study trip included also a visit of Volubilis, a 3rd century BC partly excavated Berber and Roman city in Morocco situated near the city of Meknes, and commonly considered as the ancient capital of the kingdom of Mauritania. The study trip ended in the city of Rabat, where student looked at modern architectural heritage as well as selecting and recording the site for their second semester design studio project. Students recorded their observations, studies and reflections in a series sketchbooks which will form the base for a future SAUL press publication. The objective of the study was for the students to familiarize and embed themselves in a foreign physical, cultural and environmental context so that they can understand and develop analytical skills relating to global build environment issues.

*SAUL Y2/Y3 students + SAUL lecturer, Simon Walker in Morocco*

## RTE Brainstorm

Kevin Brosnan wrote a piece on his project with Xtract360 for RTÉ Brainstorm in April. Title of article "Using maths to fight fraudulent motor insurance claims" https://www.rte.ie/eile/brainstorm/2018/0423/956537-using-maths-to-fight-fraudulent-motor-insurance-claims/

Dr Kevin Moroney provided an on line Article for RTÉ brainstorm on maths and coffee event on the 14th May 2018 Title of article: The maths behind the perfect cup of coffee. https://www.rte.ie/eile/brainstorm/2018/0514/963355-the-maths-behind-a-perfect-cup-of-coffee/

Aoife O'Neill who's research featured in an article in RTÉ Brainstorm on Wednesday 27th June . Aoife's research with Dr Helen Purtill and Prof Cathal Walsh is multidisciplinary Aoife works with researchers at MACSI/Dept Mathematics and Statistics, the Medical School, and the Health Research Institute. The article may be found here: https://www.rte.ie/eile/brainstorm/2018/0627/973541-how-that-pain-in-your-leg-may-be-aggravated-by-other-

# Winter Conferring 2018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1. Dr. Monika Zacharska, Poland and Dr. Marystela Barreto Lopes, Brazil who were conferred with a Doctorate of Philosophy
2. Dr. Kirsten Huysamen, South Africa who was conferred with a Doctorate of Philosophy
3. Ronan Downes was conferred with a Master of Science in Mathematical Modelling
4. Brian O'Connor and Farhan Ahmad were conferred with a Graduate Diploma in Chemical Engineering
5. Dr. Vincent O'Brien and Dr. Daniel O'Hare who were conferred with a Doctorate of Philisophy


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## IComp Seminar and workshop for Industrial Members

A one-day IComp seminar and workshop, took place on 14 March at the Titanic Exhibition Centre in Belfast, as a prelude to the joint IComp/KTN Out-of-Autoclave (OOA) processing of composites Conference on March 15 at the Titanic.

The seminar included presentations from IComp PIs on core project progress, round-table discussions on future IComp research directions, as well as detailed presentations from some of the KTN/IComp event guest speakers. The Evening Sessions 'Open Forum' included presentations from Professor Gianluca Cicala (University of Catania) on 'Additive Manufacturing' and Professor John Summerscales (University of Plymouth) on 'Closing the skills gap

Dr Norma Bargary, Dept of Mathematics and Statistics, has been selected as a Royal Statistical Society STEM Ambassador.

## Dates for your Diary

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| Autumn Conferring | 27th – 31st August 2018 |
| Orientation | 3rd – 7th September 2018 |
| Autumn Semester | 10th September – 22nd December 2018 |
| UL Open Days | 18th and 19th October 2017 |
| Science Week | 12th – 19th November 2017 |
| S&E Faculty Board | 20th September 2017<br>29th November 2017 |
| Winter Exam Board | 6th December 2018 |
| Graduate Career Information Evenings | 26th October: LM124/LM125<br>9th November: LM099/LM076<br>16th November: LM123/LM068/LM093<br>7th December: LM121/LM122 |

## ACS Editors' Choice

A paper written by Bernal Institute Researcher Dr Matteo Lusi has made the ACS Editors' Choice. The title of the paper is "Engineering Crystal Properties through Solid Solutions" ACS Publications manages the scholarly publishing program of the world's largest and most influential scientific society. Every year over 100,000 authors and their research teams from the community of scientists worldwide submit their work for consideration, review, and publication to ACS Publications. For ACS Editors' Choice one new peer-reviewed research article from any ACS journal will be selected to be freely available every day; the selection of these articles is based on recommendations by the scientific editors of ACS journals from around the world

## Bereavements

The Faculty extends its deepest sympathies to the following:

Dr Sarah Beecham, Lero, on the death of her mother, Mrs. Clair Llewellyn Friedman.

Bríd O'Brien-May, Bernal Institute on the death of her mother Mrs. Bridget (Tess) O'Brien

Dr. Paddy Healy, CSIS Department on the death of his mother Mrs. Mary A. Healy.

Sylvia O'Carroll, SAUL, on the death of her sister Mrs Rita Clarke

Prof. Tom Coffey, ECE Department (retired), on the death of his wife, Mrs Mary Coffey (née Cullinan)

Dr. Hussain Mahdi, ECE Department, on the death of his mother, Mrs. Fatima Hussain

Prof. Jacques Huyghe, School of Engineering, on the death of his mother

Mr. Jon O'Halloran, Bernal Institute on the death of his father-in-law, Mr Georgie Shire.

Dr. Martin Wilkinson, Biological Sciences Department, on the death of his father Mr Jack Wilkinson

Mr. John Noonan, Maths & Stats, on the death of his father Mr John (Jack) Noonan Snr

Prof. Mike Hinchey, Lero, on the death of his mother, Mrs Delia Hinchey.