2012

ResearchNews, Volume, 6, 2012

Dublin Institute of Technology

June 2012 | Volume 6

Research news

DUBLIN INSTITUTE OF TECHNOLOGY

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delivering healthy foods

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Editorial

DIT has the best record amongst Irish higher education institutions in commercialising its research. On June 19th, DIT will host its first research and innovation showcase at its Aungier Street campus. **Innovation@DIT – where Science meets Industry** is an opportunity to highlight some of DIT's successes, to demonstrate the breadth and depth of our research activity, and to engage with industry, policy-makers and funders. **Innovation@DIT** will give visitors the chance to view new and forthcoming products and services developed by DIT researchers, and to consider partnering with us to develop new generation research which can aid Ireland's recovery.

DIT is especially well-placed to meet the objectives of the Research Prioritisation Exercise outlining 14 research priorities for Ireland. Last year, DIT received about 3% of total national research funding but was responsible for 20% of all commercial licenses awarded for technologies developed in the HE sector. That is a remarkable result, and illustrates the strength of DIT's research which links use-inspired discovery with innovation. We aim to maintain that momentum in the years ahead.

DIT has recently undertaken a strategic review of our research, benchmarking our own activity against international peers and national priorities. We are organising our research around 4 Research Pillars: New Materials and Technology; Environment and Health; Information and Media Technologies; and Society, Culture and Enterprise. Each Research Pillar brings together researchers from across DIT who are committed to making a significant contribution to international knowledge and Ireland's economic recovery.

Visitors attending the Innovation Showcase will be able to talk with our researchers who are producing real outcomes, interventions and impacts that benefit the public good. In this issue there is a guide to our research centres in addition to specific information on the research being highlighted at the showcase.

Professor Ellen Hazelkorn, Director of Research & Enterprise and Dean of the Graduate Research School.

New Materials and Technologies

Head of Focas awarded funding for novel diagnostics research

Science Foundation Ireland has awarded Professor Hugh Byrne, Head of the DIT Focas Research Institute, over €1million worth of funding under its Principal Investigator Programme for his project titled 'Advancing Vibrational Spectroscopy for Cellular and Sub Cellular Analysis'.

The use of visible and infrared light for the characterisation of complex materials and chemical, physical or biological changes to them is well established. Recently, the techniques have been extended to rapid screening and diagnosis of diseases such as cancer.

This project will extend the application of these techniques to more complex analyses of the origin of changes in biological cells due to toxic or chemotherapeutic agents. It entails the development of the fundamental understanding of the techniques as well the processing and interpretation of data. It also seeks to improve the models used for assessment of biological responses.

The potential of the novel techniques will be demonstrated for chemotherapeutic and manufactured nano materials. The programme will contribute to undergraduate and postgraduate education and will interact with clinical and regulatory professionals. The project will result in novel screening techniques for improved healthcare and the development of novel medical devices.

The project targets improvements in biotechnology through developments of novel in vitro screening methods and as such bridges the Bio and ICT sectors, the Physical and Life Sciences. It builds on the world class capabilities established within Focas under PRTLI Cycle 1 and 4, laterally as part of the National BioPhotonics and Imaging Platform. It aims to further develop novel screening technologies demonstrated by DIT and others as candidates for clinical and commercial applications, promising impacts on health and benefits to Irish industry and society, consistent with the Strategy for a Smart Economy.

It builds on research that has already produced two patents on Cervical Cancer Screening and led to an Enterprise Ireland High Potential StartUp candidate company, Raman Diagnostics.

It also provides training and career progression for undergraduates, postgraduate and postdoctoral researchers as well as public sector professionals supported by DIT structured educational programmes, Ireland's two largest research platforms and the Health Service Executive (HSE). It will also exploit established international links to promote the excellence of Irish research.

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Environment and Health

Healthy options for leftover grains

Dr. Nissreen Abu-Ghannam is a senior lecturer at the School of Food Science and Environmental Health, College of Sciences and Health. Her current research team, 5 PhD students and one postdoctoral researcher, is investigating bio-mining and characterising nutraceutical ingredients from under-utilised marine resources and waste streams of the Irish agri-food industry using a range of techniques characterised as 'Green'. The nutraceuticals extracted will have potential applications in the functional food and pharmaceutical sectors. The research group has generated in the last four years over 20 peer reviewed international journals articles, four book chapters and 1 patent pending in addition to numerous presentations at international conferences. Dr. Abu-Ghannam has generated funding in excess of €2m as the Principal Investigator and in collaborative research over the last five years.

Dr. Nissreen Abu-Ghannam' s researchers are exploring ways to utilise by-products of the beer brewing industry to develop innovative new products with added health benefits. Dr. Abu-Ghannam is Principal Investigator of the project which is investigating the recycling of brewing industry waste into nutritious food products through the application of extrusion technology.

Brewers spent grain (BSG) is the main waste product from beer production (85%) and equates to approximately 20 kg per 100 litres of beer produced. According to the Environmental Protection Agency, 160,000 tonnes of BSG are produced annually in Ireland, while across Europe the figure is about 3.4 million tonnes per annum.

BSG is a valuable natural resource, containing dietary fibre (up to 70%), protein (25%), phenolic substances and carbohydrates and has potential benefits for human nutrition. However, until now, it has been sold as cattle feed, composted or disposed of in landfill and has received little attention as a marketable commodity. In fact, it is widely regarded as a problematic waste product from an environmental point of view. The recycling of brewer's spent grain has great potential due to its high availability, low cost and proven safety for human consumption.

To date, the project has gathered valuable information on the range of bioactive phenolic compounds in BSG, and a range of successful prototypes of healthy snack products has been developed. The products incorporate up to 35% of spent grains and have very acceptable sensory properties. The prototypes are high in fibre and phenolic content and have antioxidant potential. In addition the in vitro glycaemic index (GI) decreases as the level of BSG is increased, which suggests that this under-utilised waste material could be incorporated in diabetic or weight control type snacks. With an increased awareness of healthy lifestyles and the unprecedented growth of the snack market worldwide ($280 billion annually), there are significant marketing opportunities to be explored.

Sofia Reis is the PhD student on this project and her current work is focusing on developing green methods to extract more valuable ingredients such as polysaccharides for potential nutraceutical and pharmaceutical applications.

Environment and Health

Drink up your greens!

Another research team being led by Dr. Nissreen Abu-Ghannam and funded under the Strand 3 Scheme is investigating the potential of probiotic fermentation of Brassica vegetables as a means of enhancing the efficacy and nutraceutical yield extracted from these vegetables.

The Brassica oleracea species includes common Irish vegetables such as broccoli, kale, and cabbage. These vegetables account for almost half (47%) of all field vegetable production by area in Ireland with cabbage and broccoli at 19% and 13%, respectively. They are exceptionally rich in photochemicals including polyphenols, flavonoids and glucosinolates and have shown the most promise of any vegetable group for preventing chronic diseases such as cancer.

The glucosinolates found in Brassica vegetables help to protect the plant against insect invasion, but for humans they are best known for their cancer prevention benefits upon breaking down to isothiocyanates and indole. A variety of well controlled studies have shown that diets rich in Brassica vegetables decrease the risk of cancer, particularly cancers of the colon, rectum, lung, and stomach.

However, the breakdown of glucosinolates into bioactive hydrolysis products upon consuming Brassica vegetables depends on both genetics and the environment, and controlled methodologies for in vitro hydrolysis of glucosinolates into isothiocyanates for human health and nutrition are particularly of significant interest.

Methodologies for optimising polyphenolic extraction from Irish Brassica vegetables have been developed by Amit Kumar, the PhD student working on the project. He has successfully identified bio-processing conditions using a 7-litre bioreactor and a probiotic culture to break down glucosinolates into isothiocyanates. Amit has so far published seven papers in refereed journals and has delivered a number of presentations at international conferences.

"We are currently in the process of developing probiotic extracts from Brassica vegetables with high concentration of active probiotic bacteria, enhanced level of isothiocyanates with inherent polyphenols and antioxidant properties" says Dr. Abu-Ghannam. *"The dairy industry has a well-established market niche for probiotic fermentation products but the application of this technology to plant products is seriously underdeveloped"* she adds, *"there are significant opportunities to develop new product platforms for functional foods and nutraceutical ingredients from vegetables in Ireland".*

Environment and Health

Seaweed research delivering healthy foods

Dr. Nissreen Abu-Ghannam, senior lecturer at the School of Food Science and Environmental Health, is leading a Strand 3 (HEA) funded project that is researching new technologies for mining and characterising novel bioactives from marine algae (seaweeds) for applications in the nutraceutical and pharmaceutical industries. She has a post-doc and two PhD students working on her team which has already produced over 15 publications, numerous international conference presentations and has a patent pending.

The Atlantic coast of Ireland is one of the most productive seaweed growing areas in the world. Its ideal climate, over 7,500 km of rock habitat coastline, an abundance of nutrient-rich waters, and large tidal flow makes it an ideal habitat for growing seaweed. Ireland has also got one of the largest sea to land ratios (10:1) in the European Union (90,000 km2 to 900,000 km2).

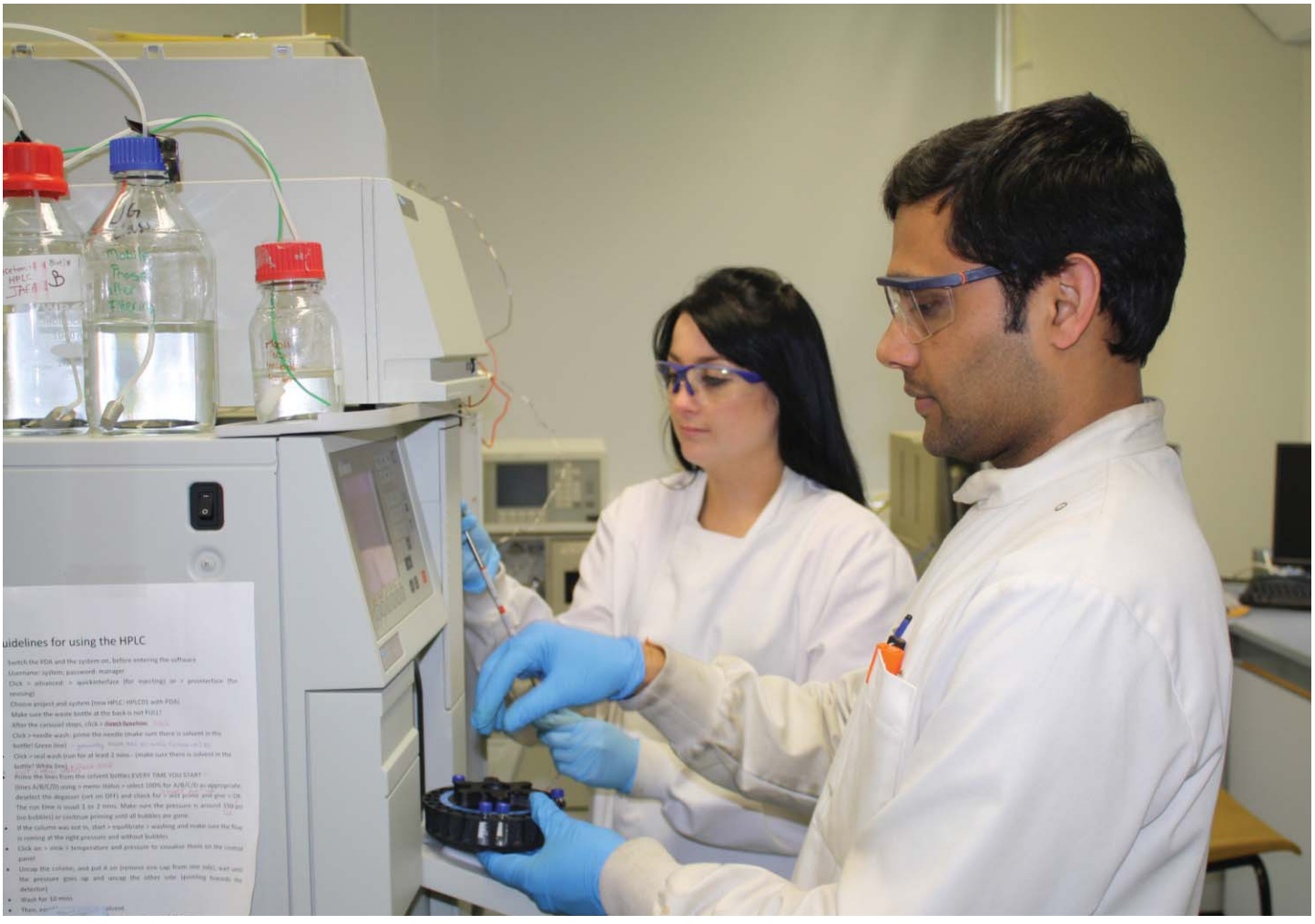
The Irish coast is home to more than 500 seaweed species but research has only focused on a small number (16-18) for commercial exploitation. According to a recent BIM report Ireland's seaweed and biotechnology sector is, however, worth €18 million per annum and projected to increase significantly in value by 2020 to around €30 million. The sector provides employment to 500 people and in the region of 30,000 tonnes of seaweed is harvested each year.

The Minister for Agriculture, Food and the Marine recently launched a public consultation process on how to harness the potential of Ireland's vast marine resource for products & services. 'Our Ocean Wealth' recognises the immense growth potential of the sector and is part of a process to develop an Integrated Marine Plan for Ireland. Dr. Abu-Ghannam's seaweed research group contributed to the consultation process by suggesting avenues of research that could lead to innovative uses for this native raw material that would move it further up the value chain.

Seaweeds are a powerhouse of natural ingredients with potent biological properties. Their anti-oxidant, anti-bacterial, anti-inflammatory, anti-cancer and anti-diabetic activities have led to a growing interest in the utilization of seaweed bioactive compounds in the biomedical, horticultural, cosmetics and functional foods and ingredient sectors. Seaweed bioactive groups are mainly polyphenols, polysaccharides, carotenoids, polyunsaturated fatty acids, proteins and peptides but their natural origin and extreme habitat can give rise to compositional variation and significant chemical diversity. Capturing this diversity and controlling variability are key challenges for future commercial applications.

The research group has evaluated seaweed drying technologies utilised in Ireland with respect to bioactive retention and has provided solutions for optimized drying conditions. A range of environmentally friendly extraction techniques were also developed to deliver extracts with outstanding antioxidant potential in addition to some promising anti-bacterial properties.

The group is currently focused on applying purification techniques (thin layer chromatography, column chromatography, liquid-liquid partition chromatography and solid phase extraction) to enhance the purity of individual phenolic compounds or extracts. The structural elucidation of purified compounds using MS and NMR will be used to characterise and quantify individual compounds. In addition a range of seaweed functional food products have been developed. The products incorporate low GI seaweed extracts or material into traditional Irish food products, enhancing their antioxidant capacity, fibre content, bulking properties and potential for weight control.



Sabrina Cox is a PhD student focusing on the evaluation of current Irish seaweed technologies with respect to bioactive retention efficiency and the development of seaweed functional foods with specific health characteristics. She was awarded best PhD student of the year at the European Federation of Food Science and Technology's (EFFOST) international conference in Dublin in November 2010, during which over 200 posters were presented.

Gaurav Rajauria is also a PhD student on this project and his work is focusing on purification techniques and characterising and quantifying phenolic based seaweed extracts. He was one of six PhD scientists (out of 110), to win a 'Significant Scientific Contribution' award at the annual Photochemical Society of Europe conference, held in Kolymvari, Crete, Greece in June 2011.

New Materials and Technologies

Electric vehicles for last mile deliveries

The Department of Transport Engineering at Dublin Institute of Technology is working closely with the ESB as they introduce Ireland's national electric vehicle charging infrastructure

DIT's principal role is to assist in the implementation and management of a pilot project focusing on Dublin City Centre in particular. This project will assess the viability of using light electric commercial vehicles in a last mile delivery scenario using a number of locally based logistic service providers to understand how these vehicles perform.

This pilot will contribute to work packages of the "ENEVATE" project, while investigating, for example, the savings in running and maintenance costs in comparison to their internal combustion engine vehicle counterparts.

"ENEVATE" is an EU funded project which aims to facilitate and support the accelerated introduction of electric mobility in the North West Europe region, through transnational cooperation between public authorities and private sector representatives. The project targets electric road vehicles, energy infrastructure, integrated mobility concepts and highlights the opportunities and challenges present in the region through pilot experiments.

As part of the wider "INTERREG IV-B" programme, the ENEVATE project aims to rapidly boost innovation and competitiveness of the expanding electric vehicle sector in North West Europe and contribute to the environmental challenge of reducing European CO_2 emissions.

As part of the pilot at DIT, our logistic service provider partners will operate the electric vehicles along routes currently serviced by internal combustion engine vehicles in a comparative study, and data will be collected using data-loggers. Information on driving conditions, vehicle and battery performance, driving habits and operational costs involved with the electric vehicles will be monitored and this data will be analysed for the logistic service providers and disseminated to industry and other ENEVATE project partners and stakeholders.

This research will also develop a clear and conclusive business case for logistic service providers in order to further promote the use of electric vehicles for last mile deliveries in Irish urban areas and will allow for the development of electric vehicle training programmes at the Department of Transport Engineering in DIT.

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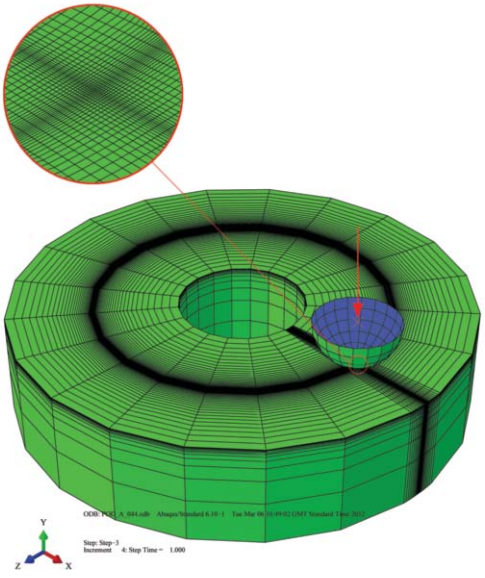
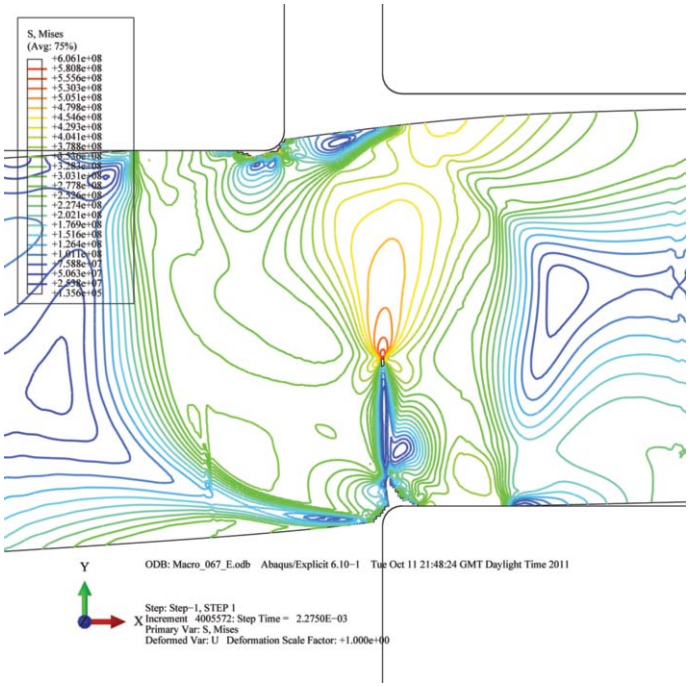
ESB ecars
Leading the charge

New Materials and Technologies

Using finite element analysis to predict wear



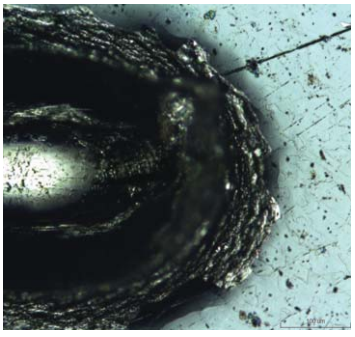


Simon Montgomery is registered as a PhD student under a joint research scheme between DIT and the University of Limerick and is being supervised by Professor David Kennedy (DIT) and Professor Noel O'Dowd (UL). He is a graduate of the Honours Degree programme of Mechanical Engineering at DIT.

His research project 'The Analysis of Molybdenum Based Coatings for Wear Applications using Finite Element Analysis (FEA)' is investigating new methods to assess the degradation of metallic coatings which aims to cut time and reduce costs when developing prototypes. Accurate prediction and calculation of wear is an elusive goal in the field of tribology. This process is very complex, featuring thermo-mechanical interactions that will remove material from the surface of a component. The potential risks inherent in the loss of material include: contamination of a working environment, excessive vibration, down-time of machines and replacement of components. The aim of this research is to investigate the degradation of metallic coatings, using computational techniques, where wear is caused by contact with, and sliding relative to, another body. He aims to predict the amount of damage that will occur for a given material in a controlled test. With this information it will be possible to significantly reduce the amount of time needed for the testing and prototyping stages of component development.

Figure 1: Pin on disc computational model
Figure 2: Shearing process, showing crack propagation
Figure 3: TiN coated sample, showing pin on disc and scratch test scars
Figure 4: Image showing bottom of scratch

Two areas of work are required to achieve these goals: physical testing of materials and computational modelling of the problem. These areas are inextricably linked as the computer model must accurately represent the physical test such that the results from both can be compared and verified. The physical tests are modelled using the commercial finite element analysis (FEA) package Abaqus, to predict the amount of material removed. Surface profiling is then used to measure the actual amount of material removed from the sample and these measurements are compared to the model output.



Prior to simulation and testing, PVD (physical vapor deposition) coatings were applied to tool steel substrates which have been machined to a bright polish finish (Ra ≈ 0.05µm). These coatings range from titanium nitride which resists wear through its very high hardness to molybdenum disulfide which eases the passage of another body over it, due to its very low coefficient of friction.

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Information and Media Technologies

Funding for energy research

The Minister for Communications, Energy and Natural Resources, Pat Rabbitte TD, and the Minister for Jobs, Enterprise and Innovation, Richard Bruton TD, have announced the approval of the first two projects as part of the government-supported International Energy Research Centre. Contracts valued at a total of €1million have been agreed between the International Energy Research Centre and four Higher Education Institutions.

The cutting-edge research projects will focus on energy efficiency and energy storage in commercial buildings, in particular:

- Using wireless networks to control and manage heating, ventilation and air conditioning systems.
- Re-designing and developing storage heating solutions.

Pictured above (l to r) Tom Flanagan, DIT Hothouse, Minister for Research and Innovation, Sean Sherlock TD, Dr. Mick McKeever DIT.

Dr. Mick McKeever, DIT Kevin Street, was awarded almost €320,000 worth of research funding for his energy research programme under the scheme. Dr. McKeever's project at DIT will develop a novel thermal energy storage unit and heat exchanger to full-scale demonstration in large commercial buildings.

The project will be carried out under the active stewardship of the IERC group of companies, which has set forth the vision for the new centre. The core group includes two Irish utilities, Bord Gais Energy and Bord Gais Networks and six world-leading multinational companies, Bell Laboratories (Alcatel Lucent), General Motors, HSG Zander, IBM, Intel and UTRC.

"These collaborations position Ireland as a lead territory where companies and third level researchers come together to develop innovative systems for world markets," said Neil Kerrigan, Head of Industrial Technologies Commercialisation at Enterprise Ireland. A further call for proposals will be issued by IERC next year.

The International Energy Research Centre is a collaboration between industry, Departments and Agencies and leading Irish and international research groups with proven expertise in technological areas which are becoming increasingly relevant to the energy challenge. It is hosted by the Tyndall National Institute in Cork. It is supported by the Department of Jobs, Enterprise and Innovation and the Department of Communications, Energy and Natural Resources working with a coordinated agency project team of IDA, Enterprise Ireland, Science Foundation Ireland and the Sustainable Energy Authority of Ireland.

Dr. McKeever was also awarded €80,000 under the Enterprise Ireland 'Commercialisation Plus' funding programme for another research project which will aim to produce a commercial prototype of the "Warmer Wedge" for commercialisation and marketing. The Warmer Wedge is a domestic hot water storage system for use in the home that Mick has already developed. It is a modular system that doubles the hot water capacity of an existing tank and allows home owners to meet all their hot water needs and future proofs against energy tariff changes.

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New Materials and Technologies

CREST exhibits new technology at 1st EU Innovation Convention

New Irish technology that kills MRSA and other disease-causing pathogens played a starring role at the first European Innovation Convention which took place in Brussels in December.

The light-activated antibacterial surface coating was developed by a DIT research team at the Centre for Research in Engineering Surface Technology (CREST). With funding from Enterprise Ireland, the research team worked with VitrA Ireland, to convert the photocatalytic technology into a commercial product for use on ceramics.

The ground-breaking technology was one of only 50 star projects selected from over 450 entries to participate in Europe's premier innovation event and CREST was the only Irish research organisation invited to be present at the Convention. At the opening of the event, EU Commissioner for Research, Science & Innovation, Máire Geoghegan Quinn visited the stand where she met the team and was presented with a sample of the anti-bacterial coated tiles, featuring the DIT and Vitra logos. The Commissioner was accompanied by the President of the European Investment Bank, Phillipe Maystadt, following their official agreement to provide a €6bn finance facility for SMEs involved in research and innovation.

EU Commissioner Máire Geoghegan-Quinn congratulates Dr. John Colreavy, Centre Director, CREST, at the Innovation Expo in Brussels

New Materials and Technologies

Student wins best poster award at International conference

The Associated Schools of Construction (ASC) is a professional organisation which was set up as a means of bringing together various schools of construction in colleges throughout the world but mainly the USA. Originally established in the 1960's, the ASC has allowed for idea sharing, cross communication and collaboration between respective schools of construction.

In order to effectively cover the entire US, the association is split into seven different regions with each one having a director and associated committee. In recent times the ASC has spread into a worldwide capacity with region eight encompassing schools of construction outside of the United States. The ASC is heavily involved in communicating to students in the classroom and each region holds a separate design/build competition aimed at improving student learning and co-operation. The competitions test every aspect of the construction student's abilities and involve multiple disciplines including, construction management, engineering and architecture. DIT's School of Construction is a member of the ASC and has been involved in the region 5 design/build competition for the past 3 years.

Brendan Towey, an MPhil student in the School of Construction recently won the best poster award at the 48th annual ASC International Conference. Brendan's first Involvement with the association stems back to when he took part in the region 5 design/build competition held in Dallas in February 2011. As a final year construction management student, Brendan's input helped the combined team of three DIT students and three Oklahoma University students win the international design/build category.

From this excellent experience, Brendan began an MPhil in October 2011 and has made steady progress to date. His research area is timber frame construction with particular attention to energy performance of timber structures. His current research is focused on the improvement of the air-tight capabilities in timber frame buildings and this was the main focus of his winning poster. The 48th International ASC conference offered an excellent opportunity for Brendan to submit his first abstract for the poster presentation section of the conference. The conference was held in Birmingham City University and this marked the first time the ASC annual international conference had been held outside the United States.

Brendan Towey, DIT M.Phil student being presented with bester poster award by Dr Mary Nobe, ASC poster session moderator

The two-day gathering consisted of many interesting presentations but also included activities such as a site visit to the new campus building under construction by Birmingham City University and an end of conference gala dinner held in Villa Park football stadium. Brendan's submitted abstract detailed the early stages of his research in which he explored new connection methods between closed panel timber frame walls. The poster, produced for the conference, details a further stage of research including an opportunity to test the new connection methods in a 'live build' situation.

As Brendan describes; *"The poster presentation best suited my overall stage of research as the inclusion of multiple photographs and images allowed viewers to gain an aspect of where my research is progressing to. I had many positive and encouraging comments from delegates attending the conference, not least from other researchers and fellow poster presenters."*

In total there were 10 poster presentations. The poster judging was peer reviewed by delegates and the poster session moderator, Dr. Mary Nobe. Brendan's entry was announced as the winner on the final day of the conference much to his delight. *"My main aim for the conference was to meet people whom are involved in research and also in construction, having my research recognised by the other attendees and the overall interest into my field of study made the ASC conference an excellent starting point and surpassed all expectations."*

Brendan is currently in the first year of his M.Phil and will use the conference experience as a positive building block for the continuation of his research.

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New Materials and Technologies

Bord Gáis Networks and DIT launch research project

Bord Gáis Networks and Dublin Institute of Technology are co-funding a doctoral research project analysing small and medium enterprises' heat consumption in Ireland.

Under the Dublin Institute of Technology Fiosraigh—Bord Gáis Networks Award, PhD student, Ronan Oliver will undertake research which will examine the implications of energy usage in the SME sector and its implications for developing a low-carbon economy.

The research project is being undertaken as part of the Dublin Institute of Technology Fiosraigh— Enterprise Scheme, an initiative through which DIT can partner with external, industry partners to support PhD students.

Dr. Aidan Duffy (DIT), Professor Karsten Menzel (UCC) and Ian Kilgallon, Regulatory Affairs and Process Manager (Bord Gáis Networks) will be the academic supervisors for the project. Speaking at the announcement, Dr. Mike Murphy, Director and Dean of DIT College of Engineering and Built Environment welcomed the collaboration and looked forward to future opportunities for engagement between Bord Gaís Networks and DIT.

According to John Barry, Managing Director, Bord Gáis Networks, the research collaboration marks an exciting development in the relationship between the two organisations.

Bord Gáis Networks, on behalf of Gaslink, develops, operates and maintains the natural gas transmission and distribution networks in Ireland and provides gas transportation services to suppliers and shippers.

Natural gas is available in over 153 population centres within 19 counties throughout the country and there are over 640,000 gas users in Ireland.

Bord Gáis Networks has been collaborating closely with DIT over the past year under a Memorandum of Understanding which was signed in 2010.

"This research will provide Bord Gáis Networks with a greater understanding of SME natural gas consumption and may influence policymaking in the future. We look forward to working with Ronan and DIT on the project,"

It recently became the latest member of the DIT Corporate Partnership Network and has been accredited by DIT as a partner for educational collaboration.

Mr. John Barry, Managing Director, Bord Gaís Networks, PhD student, Mr Ronan Oliver and Professor Brian Norton, President of DIT

Society, Culture and Enterprise

Hothouse celebrates 10 years and launches new programme

DIT Hothouse marked the 10th anniversary of its Venture incubation programme for business start-ups and recognised the achievements of its leading entrepreneurs and researchers at its Annual Hothouse Showcase in Croke Park.

Since its establishment in 2001, the DIT Hothouse Venture programme for knowledge-intensive start-up companies has assisted over 250 new entrepreneurs to create over 1,000 jobs in the Dublin region. Graduate companies from the programme have attracted a total of €94 million in equity investment.

At the Showcase the leading entrepreneurs from the latest Venture Programme were presented with awards by special guest Declan Conway, founder of Openet Telecom. Based in the Docklands Innovation Park, the year long Venture Programme provides incubation space, mentoring and expertise to assist a new generation of Irish entrepreneurs create successful businesses. Many of these companies leverage DIT research and employ DIT graduates and students. Some notable successes from the programme include: Mick's Garage, one of the UK and Ireland's leading online car-part retailers; Sigmoid Pharma, winner of 2010 Irish Times Innovation Award; healthcare specialists BiancaMed and Decawave, fabless semi-conductor firm.

The Hothouse Showcase recognised the achievements of DIT researchers who have successfully commercialised their research during the past year. DIT Hothouse has consistently delivered a commercialisation rate above that of most universities in Europe and the United States. The centre has licensed or optioned over 30 technologies from DIT to companies such as Sony, Microsoft, Bausch & Lomb, Fleetwood Sherwin Williams, General Paints, Bord Gaís, ESB, Monaghan Mushrooms, Decawave, RendezVu and Sequoia Smart Solutions. The centre has also spun out several start-up companies based on DIT research.

Bernadette O'Reilly being presented with her award by Professor Brian Norton, President of Dublin Institute of Technology.

New programme launched

In March, Seán Sherlock T.D. Minister for Research & Innovation launched 'New Frontiers', Ireland's largest entrepreneur development programme. New Frontiers is a national programme funded and coordinated by Enterprise Ireland and will be delivered locally by 13 Irish Institutes of Technology, including DIT and it replaces the Hothouse Venture programme.

Announcing the details of the programme Minister Sherlock said: *"The focus of the New Frontiers programme is developing people into entrepreneurs — laying the foundations and imparting the entrepreneurship skills needed to move from business concept to reality."*

"Enterprise Ireland is working in partnership with the Institutes of Technology to ensure that the participants create sustainable businesses, jobs and economic stability in regional locations. By giving the individuals the skills they need to successfully set up and run a company, they will be capable of replicating that success with other ideas in the future."

DIT Hothouse has already delivered the first phase of the three-phase programme that is designed to provide an integrated and comprehensive set of business development supports to participants. Following a competitive selection process, some of the participants were offered a place on Phase 2 and will receive intensive support for 6-months followed by a third phase.

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Society, Culture and Enterprise

Business plan for innovative product wins enterprise competition

The team behind Nero-Hero, a new neoprene swimming garment that helps learner swimmers to keep afloat, won this year's Bolton Trust/DIT Student Enterprise Competition. Team members, Daniel Minogue, David Manton, John Healy and Robert McCarthy, who are studying Product Design in DIT Bolton Street, received a €2,000 cash prize. The team's design is a neoprene garment that raises the body of the user into the correct position while swimming, to improve technique.

The four teams shortlisted for the final presented their ideas and accompanying business plans to a panel of expert judges on the night. Nero-Hero was judged to have the best strategy for the manufacture, sale and marketing of their eye-catching invention. They also outlined a series of products that they could develop in the future using the same technology. Dressinade took second prize with their plan to develop a range of marinades and dressings and picked up a special prize for Best Market Research. The other two business ideas presented were a new craft beer developed by the Red Head Brewing Company, and a smart phone application created by team Emergency Services App. The DIT/Bolton Trust Student Enterprise Awards have been running for almost 20 years.

Pictured right: David Manton and Daniel Minogue, part of the Nero-Hero team.

The Trust was established in 1986 by staff of the Dublin Institute of Technology to promote new business enterprise in Ireland. Sponsors of the Awards are the Bolton Trust, Hothouse and AIB. Commenting on the Awards, Mr John Kelly of AIB said, 'This year is the first year of AIB's involvement with The Bolton Trust/DIT Student Enterprise Competition in a sponsorship which is part of a 3 year agreement. We are delighted to be supporting this initiative as it shows our commitment to students and enterprise and it is an exciting and promising partnership.'

Hothouse company win global entrepreneur competition

DIT Hothouse graduate company Profitero, which makes pricing intelligence software, has been named IBM Global Entrepreneur of the Year at an event in San Francisco. Profitero, which won the IBM SmartCamp London award in November, was the only Irish company competing in the 2012 IBM SmartCamp Global Final in Silicon Valley. Profitero analyses competitor pricing data, offering retailers new levels of insight to help them maximise profits by adjusting pricing and merchandising strategies. As the volume of data on the planet grows, the ability to quickly transform data into insight is critical for success. Profitero represents a new generation of entrepreneurs entering the market with technology designed to capitalise on the big data analytics opportunity.

The Profitero team at the IBM Global Entrepreneur Awards in San Francisco.

"We are honoured to be named the IBM Global Entrepreneur of the Year," said co-founder and CEO Vol Pigrukh. *"Our solution is a natural complement to IBM's Smarter Commerce strategy. We are looking forward to working with IBM and its network of technical experts, business partners, venture capitalists, academics and clients to capture our share of the smarter commerce opportunity."*

www.profitero.com

New Materials and Technologies

SDAR finalist makes significant cost reduction

The 3rd annual Sustainable Design and Applied Research (SDAR) awards final was organised and hosted by the School of Electrical Engineering Systems in DIT Kevin Street in March. This is one of the Chartered Institution of Building Services Engineers (CIBSE) major applied research events intended to disseminate best practice in innovation and evaluation and to promote collaboration between industry and academic institutions. It was sponsored by John Sisk & Son and supported by Building Services News.

The event is growing in popularity each year as evidenced by the quantity and quality of papers submitted. The critical evaluations delivered potential energy savings and cost reductions to the companies involved and the winning paper delivered an impressive cost saving of about €100,000 within the first year. The intention is to move from ideologically based ideas and innovations to proven value energy reduction for clients. The idea is to encourages applied research in companies and ensure quality and value in innovation projects. The role of CIBSE is to facilitate this process and disseminate the findings.

The four finalist's papers were all real world industry-focused research papers and the presentations were very well received by both the audience and the panel of expert judges:

- Establishing Current Energy Management Practices in Irish Manufacturing SMEs, Dermot Lyons, GSH
- Comparison of Ice-bank Actual Results vs Simulated Predicted Results in Carroll Refurbishment Project DKIT, Edel Donnelly, BDP
- Improved Automation Routines for Automatic Heating Load Detection in Buildings, Stephen Timlin, BDP
- Radio Telefís Éireann Retrofit Energy Strategy for the Television Centre's Chilled Water System, James McConnologue, RTE.

The well deserved winner was James McConnologue, who investigated the energy performance of a building's chilled water system (CHWS), primarily focusing on the systems direct electrical energy consumption. The successful retrofit of the CHWS delivered an impressive cost saving of about €100,000 within the first year. This was achieved with a minimal capital investment of €3,400 for the purchase of a MODBUS interface.

The judging panel consisted of Michael McNerney (Energy MCS & CIBSE), Kevin Gaughan (Chair of the MSc in Energy Management, DIT), Kevin O'Rourke (Sustainable Energy Authority of Ireland), Justin Keane (John Sisk & Son) and Brian Geraghty (Brian Geraghty Associates & CIBSE).

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James McConnologue (RTE), Stephen Timlin (BDP), Edel Donnelly (BDP), Dermot Lyons (GSH)

Justin Keane (John Sisk & Son), Winner James McConnologue (RTE), Derek Mowlds (chairman CIBSE)

Michael McDonald (DIT)

Event organisers: Dr. Kevin Kelly (DIT) and Keith Sunderland (DIT), with Alan Duggan (CIBSE Chair) and Justin Keane (John Sisk & Son)

New Materials and Technologies

New stent research aims to help cardiac patients

Dr. Fergal Boyle is leading research that is focused on investigating how coronary stent design may influence the clinical outcome following stent deployment procedures in cardiac patients. He is currently supervising two PhD students who are using numerical and statistical methods of analysis to determine the relationship between stent design and the likely risk of in-stent restenosis.

Coronary heart disease refers to the failure of the coronary circulation to provide an adequate supply of blood to the heart. It is the leading cause of death and disability in the developed world and is generally attributed to the narrowing and stiffening of the coronary arteries. This narrowing and stiffening of the coronary arteries is caused by the development of atherosclerotic lesions in the artery wall. Over the course of decades these lesions stiffen and increase in size such that the flow of blood to the heart becomes compromised.

Stent implantation is currently the preferred treatment for coronary heart disease with the worldwide market worth approximately $5 billion annually. A stent is a small cylindrical medical device that is expanded within the narrowed segment of a coronary artery in order to restore the flow of blood to the heart. Though treatment with a stent generally results in favourable clinical results, re-narrowing of the artery is observed in up to 30% of patients. This re-narrowing is referred to as in-stent restenosis and it is generally attributed to stent-induced arterial injury and alterations to local vessel hemodynamics.

In the first study David Martin, PhD student, is developing a numerical methodology to investigate the mechanical and hemodynamic impact of stent design. He has developed a finite element procedure to investigate the degree of stress incurred in the coronary artery during the deployment of typical balloon-expandable stents. Using the results from the finite element analyses, he has developed a computational fluid dynamics procedure to investigate the influence of stent design on local vessel hemodynamics. The results of this study should provide a considerable insight into the link between stent design and the potential risk for in-stent restenosis following stent deployment procedures in cardiac patients.

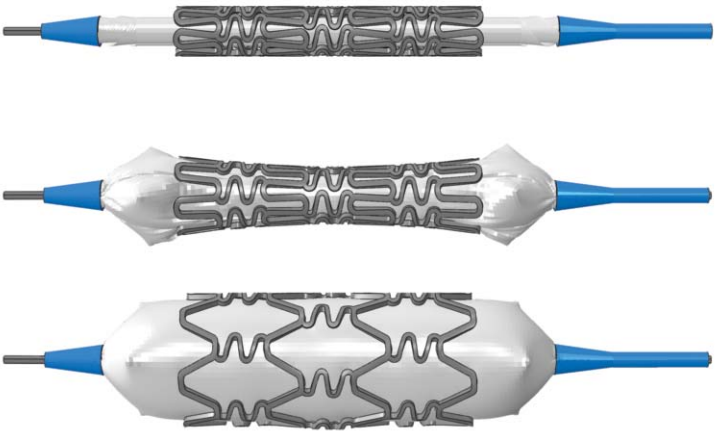
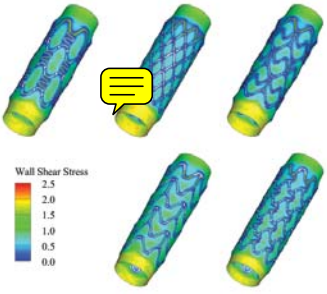


Figure 1: Numerical analysis of coronary stent deployment



Natural blood flow in the arterial system has been found to be helical in nature and has several hemodynamic advantages in terms of inhibiting the development of atherosclerotic lesions and in-stent restenosis. In the second piece of research Eoin Murphy, PhD student, is using computational fluid dynamics and statistical analysis coupled with an understanding of the influence of hemodynamics on cellular processes to compare a new stent design, which elicits helical flow, with existing stent designs. His research has the potential to influence future stent designs in order to reduce the risk of in-stent restenosis and improve clinical results following stent deployment procedures in cardiac patients.

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New Materials and Technologies

DIT Contributes to new generation Intelligent Port Technology

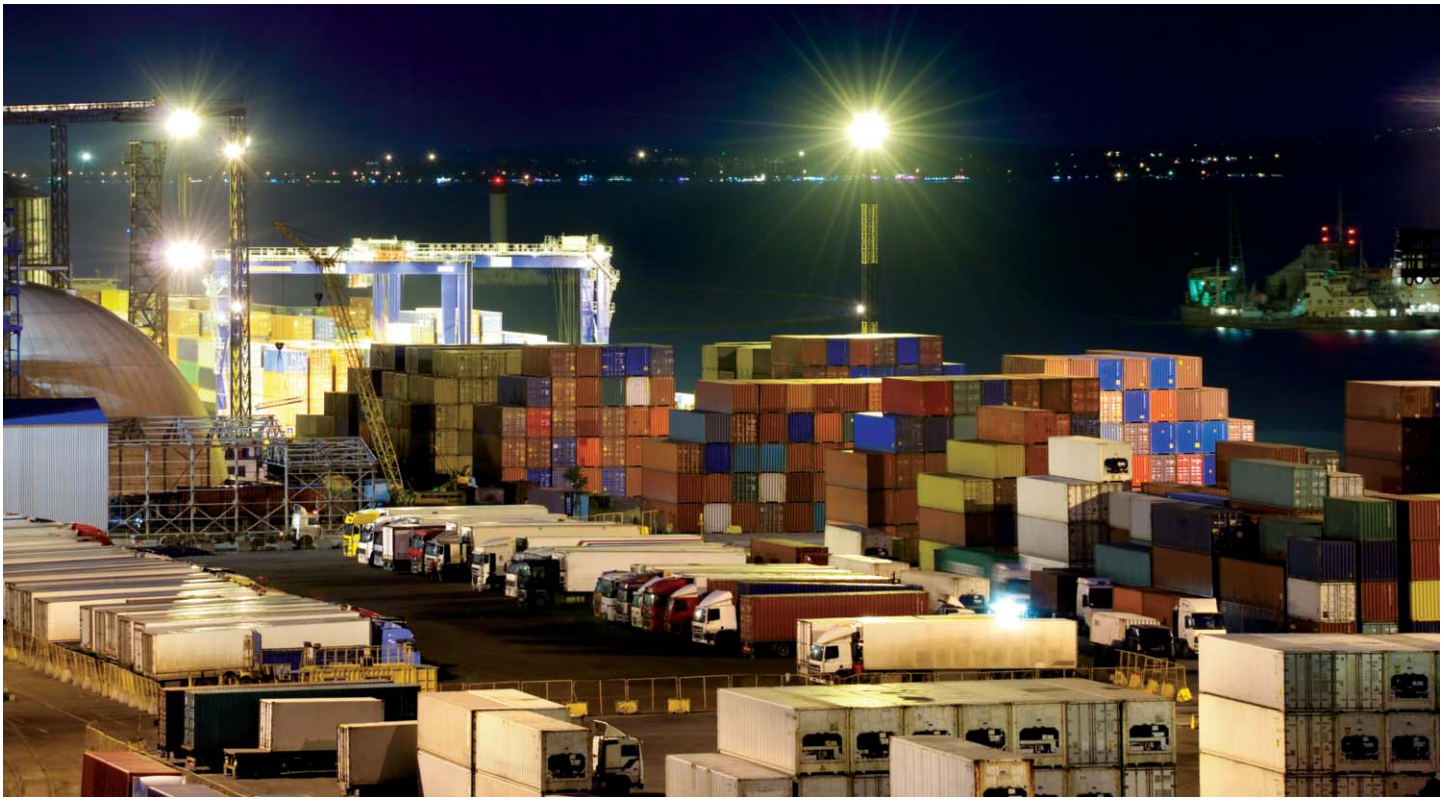
Ports play a vital role in economic growth by attracting and generating trade. A port that is not capable of coping with rapidly advancing technologies will not be in a position to foster the development of the trade sector. This has led the drive to improve efficiency, lower cargo handling costs and integrate port services with regard to lowering emissions and noise, while maintaining safety and security.

The main problem with handling increasing levels of cargo is managing the internal traffic and optimizing space inside smaller and medium sized ports. Recognising the need to improve cargo handling in the small and medium sized ports in North West Europe (NWE) the Department of Transport and Engineering at Dublin Institute of Technology (DIT) with Dublin Port Company as a sub partner have joined a consortium led by Polytech Lille Cite Scientifique (LAGIS), France headed by Professor Rochdi Merzouki. Other partners include Institut National de Recherche et Informatique et Automatique (INRIA-Loria) France, Central Regional d'Innovation et de Transport de Technologie Transport et Logistique (CRITT TL) France, AG Port of Oostende (AGHO) Belgium, Liverpool John Moores University (LOOM) UK.

A new generation of cargo handling technology has been designed in the framework of InTraDE (Intelligent Transport for Dynamic Environment). The project has received European Regional Development funding through InterReg IV B. Participation in the project will contribute to improving traffic management and space optimisation inside confined space by developing a clean safe Intelligent Transport System (ITS) such as an Intelligent Autonomous Vehicle (IAV). This system will adapt to the specific environment requirements and could be transferred to different sizes of ports and terminals. The transportation system operates in parallel with virtual simulation software of the automated site, allowing a robust and real-time supervision of the goods handling operation. Therefore, no infrastructure requirements or investment.

The main aim is to improve productivity in ports in order to improve their competitiveness. The project will contribute to the effort of national and EU governments in diverting some road traffic elements to maritime coastal highways by improving the efficiency of short sea shipping within the region. It will also improve the operational safety and reduce the environmental impact of regional container ports.

The IAV is similar to the Automated Guided Vehicle (AGV) currently in use in some of the bigger EU ports but is technologically superior as it is battery operated making it more economically and environmentally efficient. In contrast to the AGV, the IAV does not have to follow designated routes embedded in the infrastructure to reach its destination.



The vehicle is an individual unit which can also work in groups allowing it to form a platoon similar to a train with locomotives. The unit capacity of an IAV is one TEU (twenty foot equivalent unit). Two IAV's will be required to transport two TEU or one forty foot equivalent unit (FEU). All four wheels have actuators and a failure in any of the wheels individually does not stop the vehicle from operating. The wheels offer 360 degrees movement allowing the vehicle to move in any direction within a confined space.

The vehicle is a multi-input, multi-data (MIMD) system equipped with several sensors which will enable it to benefit from Geographical Positioning System (GPS), to move unmanned around port terminals, delivering containers to and from marshalling areas. Although the IAV is not exactly new, what makes it different is that it does not require a guidance system such as rails or transponders set into the ground (a costly undertaking). Traffic management and space optimization is a problem with the future development of port terminals in NWE. The problem can be solved by having a remote 'traffic control centre' directing vehicles to marshalling areas where the containers are handled by IAV's.

IAVs will improve the traffic in international ports in terms of congestion, when the volume of vehicles is dense according to space motion. These vehicles will alter their speeds and trajectories according to the traffic status and the environmental changes such as pollution and noise.

The auto-control will help significantly in decreasing the emission rate of pollution gases during the vehicles mission. In order to meet requirements of a changing industry and to service the needs of a rapidly developing economy in the long term, the IAV will reduce the time lost in moving cargo from ship to stacking areas and vice versa by 10%. In turn, this will impact on the turnaround time of vessels, a crucial factor in port and vessel efficiency. In addition, the environmental benefits will include a 20% reduction in air pollution.

A workshop will be held in late 2012 where the IAV will be demonstrated in Dublin Ferryport Terminal (DFT) one of three container terminals located in Dublin Port. The Department of Transport and Engineering in DIT with its extensive experience in transport and logistics operations and technology will contribute significantly and demonstrating its expertise in ITS will enhance the project. DIT staff Declan Allen, Roisin Murray and Kay McGinley are co-ordinating and monitoring the Dublin based project.

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Information and Media Technologies

Antenna and high frequency Research Centre

Dublin Institute of Technology's Antenna & High Frequency Research Centre specialises in the analysis, design and measurement of antennas and associated devices for wireless communications and medical applications. With more than 15 years of applied research experience it has built an international reputation for innovative futuristic concepts and solutions to contemporary industrial challenges. The AHFRC has worked with a number of companies since its establishment including: Airvod, Alcatel-Lucent, Railway Procurement Agency, Decawave, Dell and Biancamed.

Current research themes include Multiband & Wideband Antennas for Portable Communications, Base-Stations Antennas, Hyperthermia Antennas and Antennas for Sensor Networks. Equipped with a comprehensive range of analysis methods, manufacturing equipment and a measurement laboratory, the team can rapidly expedite ideas to qualified prototypes.

The research team is directed by Professor Max Ammann, School of Electronic & Communications Engineering, and is part of CTVR — the Telecommunications Research Centre. CTVR carries out industry-informed research in wireless and optical networking. Its headquarters are in Trinity College Dublin (TCD) but Dublin Institute of Technology (DIT), the National University of Ireland, Maynooth (NUIM), Dublin City University (DCU), Tyndall National Institute, University College Cork (UCC) and University of Limerick (UL) are all involved. Each institution brings different expertise to the table. There are seven core CTVR industry partners: Alcatel Lucent/ Bell Labs Ireland, Xilinx Research Labs, Eircom, NXP, M/A Com Technology Solutions, Socowave and Intune Networks but the academic partners also work with other companies on industry-focused projects.

Miniaturised UWB Telemetry Antennas for Body-Centric Communications

The research project is being led by Professor Max Ammann with Dr. Patrick McEvoy and PhD student Domenico Gaetano. It focuses on antenna design for telemetry in body-centric sensor networks. The challenges include the selection of robust electromagnetic materials, antenna optimisation for compatibility with human physiology and the mitigation of adverse ground-level propagation effects. Radio-linked sensors, which will facilitate detailed real-time analysis, will also overcome the restricting influences of trailing wires on the natural gait and lower leg activity of users.

In collaboration with specialist physiotherapy researchers at the RCSI, the antenna team propose to use CST's Microwave Studio, a Finite Difference Time Domain-based predictive modelling technique, to account for the electrical properties of the limbs, clothing and postural influences. Network analyser measurements will be used to validate prototype designs and experimental radio links will test the design suitability for typical on-body and off-body communications channel scenarios. The measurements analysis will be carried out in both anechoic and reflective environments in order to describe the antenna performances.

The study will consider flexible, conducting materials for integration with various footwear types and new techniques for supporting reliable microwave connections with radio systems in fabrics. The physiotherapists will investigate the influences of wireless devices on patient behaviour. The research will define the best approaches to miniaturising radio antennas for emerging networks that will monitor pressure, environmental conditions or tracking sensors. The research will bridge significant knowledge gaps to liberate growth in manufacturing sectors that are exploring opportunities with body area network devices. This research will tackle the challenges to antenna design which footwear sensors require for emerging medical, occupational and leisure applications. While miniaturised microchip radios are available, new antenna techniques are necessary to enable footwear connections with upper-body and off-body data analysis systems.

Telecommunications Graduate Initiative

The Telecommunications Graduate Initiative (TGI) has the primary aim of making Ireland the best European location for research in the broad domain of telecommunications including physical transportation of data, networking protocols/architectures and telecommunications service delivery. Work in these disciplines is underpinned by advanced mathematical techniques and generic skills targeting research methods and innovation.

Research in ICT is the primary focus of research activity at the School of Electronic and Communications Engineering at DIT. The ICT area has been identified as a strategically important research strength for DIT. There are currently twelve permanent academic staff engaged in ICT research.

There are three substantial signature ICT research areas, Wireless Communications Systems; Antennas & High Frequencies and Photonics. Each of these signature areas is underpinned by a group led by one or more Principal Investigators with the support of other academic staff, several post-docs, dedicated accommodation, doctoral graduate students, access to funding and proven substantial outcomes in publication and/or intellectual property and commercialization metrics. There is also a range of other ICT related research areas including liquid crystal switching for optical networks, MIMO systems, high speed transmission over powerlines and wireless channels and distributed systems. This module is an introduction to modern Antennas — Design and Technology. The aim of this module is to provide a broad understanding of antenna theory, design and practice with respect to real world wireless communications systems and devices and to understand the building blocks and design process for fundamental antenna elements. On completion of this module, the learner will be able to:

- *Describe fundamental and advanced concepts associated with antenna design, performance and operation within real world environments*
- *Identify a broad spectrum of antenna types used in today's wireless communications markets*
- *Evaluate properties of antennas with a detailed knowledge of factual and fundamental antenna theory*
- *Evaluate advanced performance trade-offs associated with antenna design*
- *Use advanced electromagnetic simulation software and model a family of antenna types.*
- *Design antenna elements for modern wireless systems*
- *Discuss the theories associated with the implementation of phased array antenna systems*
- *Describe how antenna performance and the RF propagation environment impact wireless communication system performance*

Compact and High-Performance Circularly Polarized Antennas for the Integration of Wireless Positioning, Communications and Asset Tracking Systems

The research project is being led by SFI Starting Investigator Dr. Xiulong Bao with PhD student Adam Narbudowicz, under the mentorship of Professor Max Ammann. The research involves antenna design which can support circular polarisation across unprecedentedly broad bandwidths which can lead to viable design solutions for integration with miniaturised radio systems of the future. Balancing antenna performance across competing parameters is a key enabler for microwave communications as it evolves from established social telephony uses to linking advanced wireless networks. Circularly polarised radio propagation links in satellite communications, satellite positioning and radio frequency identification (RFID) systems are preferred to linear schemes which are subject to losses when arbitrary polarization misalignment occurs between the transmitter and receiver. With CP antennas at both radios, the enhanced gain and cross-polar discrimination improve the system's resilience to multipath propagating effects. While antenna miniaturization is desirable for small and portable devices, radio links are dependent on a balance of antenna bandwidth, efficiency or polarisation quality which are inherently compromised by size reduction. The challenges are particularly acute in adverse environments due to congestion and variable propagation conditions.

Antenna Time-Domain Optimization Technique for a Miniaturised Antenna Design

This project centres on antenna optimisation for signals that exploit time-domain characteristics in communications and ranging systems. Multi-jurisdictional ultra wideband standards (IEEE 802.15.4a) have been allocated frequency spectra for short range, low-powered applications that are sensitive to impulse distortion. Impulse Radio — Ultra Wideband (IR-UWB) use signals in the pico- to nano-second range. To preserve signal quality, it is essential that the antenna does (1) not add significant distortion to the transmitted or received signal and (2) the radiated energy pattern does not introduce significant variation to the signal time of arrival at different angles. In general, the miniaturisation of antennas compromises several of the radiating performances that reduce the communications range or data throughput performances. Fidelity metrics to quantify these effects used to optimise the miniaturisation of single-ended and balanced-feed antenna geometries for time-domain-based applications. PhD Student Antoine Dumoulin is carrying out this work with guidance from Professor Max Ammann, Dr. Matthias John and Dr. Patrick McEvoy.

Enhanced Ultra Wideband Antennas for Ground Penetrating Radar and Biomedical Imaging Applications

This work is driven by Dr. Giuseppe Ruvio in collaboration with the Second University of Naples, Italy, where a prototype biomedical imaging system will be used to qualify system performance due to the various antenna designs created. Numerical models of the human body are used to analyse the antenna interaction with multi-layered human tissues. Optimised antennas will be a critical enabler for the realisation of cost effective sub-centimetre image resolution using a UWB impulse method. The research will quantify the merits of integrating three advanced electromagnetic design techniques into antennas with the objective of enhancing emerging applications. For example, through antenna size reduction, biomedical imaging systems will have improved access to otherwise restricted areas on the human body. This project explores the integration of tapered feeds and metamaterial surfaces into dipole, horn and leaky wave antenna geometries in order to minimise their pulse-distortion, size and weight. Feed structures will be optimised to equalise the power carried by resonant modes in directive UWB antennas. The goal is to enhance UWB antennas for Ground Penetrating Radar and Biomedical Imaging Applications.

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New Materials and Technologies

Modelling of biomass gasification integrated with advanced power systems

Wayne Doherty is a PhD student in DIT's Dublin Energy Lab. He is part of the 'Traditional and Sustainable Energy Research Group' and is supervised by Dr. Anthony Reynolds and Professor David Kennedy.

In the context of both climate change mitigation and energy security, biomass is among the most promising renewable energy sources. Traditionally, energy is recovered from biomass through combustion at low electrical efficiency. Biomass gasification coupled with fuel cells offer much higher efficiencies. These systems offer highly efficient renewable energy and are modular in nature. This makes them ideal for decentralised combined heat and power applications.

Gasification occurs when a controlled amount of oxidant is reacted at high temperatures with fuel within a gasifier, producing a combustible gas. Both the circulating fluidised bed air gasification and dual fluidised bed steam gasification technologies were modelled. Solid oxide fuel cells (SOFCs) are well suited to integration with gasification due to their high operating temperature and fuel flexibility. They convert the chemical energy contained in a fuel gas directly to electrical energy via electrochemical reactions, making them highly efficient. The main objective of this research was the development of computer simulation models for biomass gasification-SOFC systems and to investigate their feasibility through economic analyses. Aspen Plus was utilised to develop the system models.

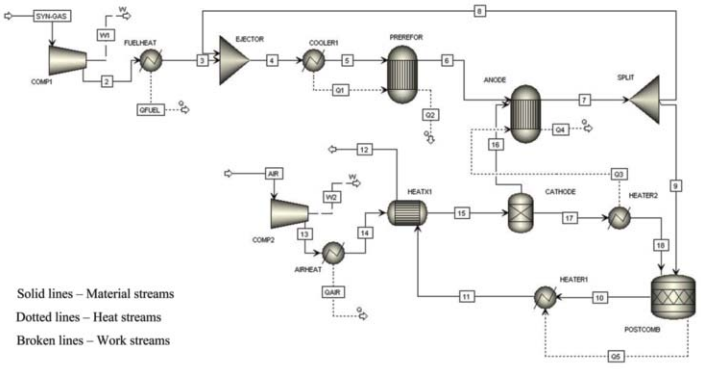

Figure 1: an example of the Aspen Plus models that were developed: tubular SOFC stack

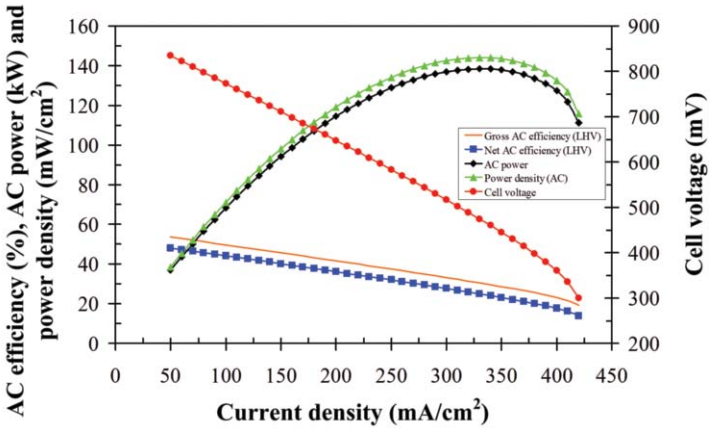

Figure 2: Effect of SOFC current density on voltage, efficiency and power

Stand-alone models of the two gasification technologies and the chosen tubular SOFC design were developed and validated against published data. Sensitivity analyses to investigate the influence of the main operating parameters were conducted. These models were then integrated including gas cleaning and balance of plant components (heat exchangers, compressors etc.) and various system configurations were evaluated. The levelised cost method was applied to determine the minimum price at which the generated electricity must be sold.

Motivation for research

- Environmental considerations, energy security and energy efficiency.
- Too much focus on wind power in Ireland.
- Biomass utilisation creates jobs (grown, harvested, processed, transported and converted).
- Biomass can be used for electricity, heat and transport.
- Ireland has best growth climate in Europe.
- There is a lack of research on integrated gasification fuel cell systems.

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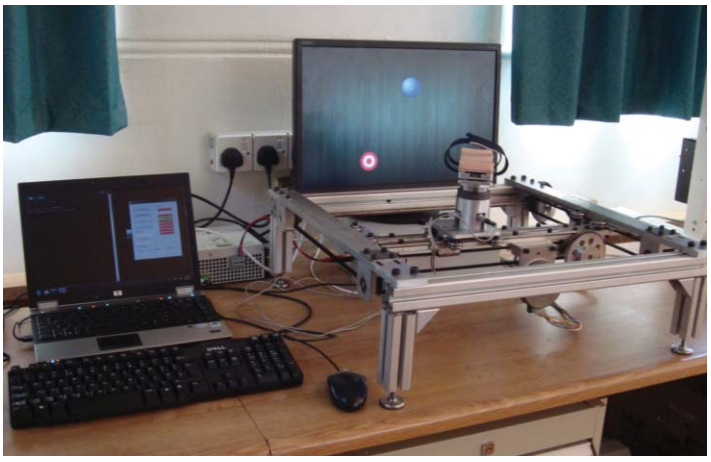
New Materials and Technologies

Using robotics for post-stroke upper limb rehabilitation

Limb impairment, such as that caused by stroke, can seriously affect a person's ability to perform the activities of daily living. However, even though areas of the brain that control motor function may be damaged during a stroke, the brain has the ability to adapt so that these skills can be relearned over time.

To achieve this, therapy intensity has been shown to be crucial. The application of robotic devices to limb rehabilitation has also been shown to have a generally positive effect on recovery.

Stephen Curran, PhD student, is developing a suitable robotic platform (pictured opposite) to explore the application of robotics to rehabilitation therapy. He will focus on the use of these types of robots in a non-specialised (i.e. outside of a rehabilitation hospital) or domestic setting. The use of rehabilitation robots in a non-specialised setting could potentially reduce the costs of intensive rehabilitation therapy and allow it to be administered for longer periods. This is a multi-disciplinary project with significant mechanical, electronic and software components.



To date, work has focussed on developing a suitable planar robotic device for the rehabilitation of the shoulder/elbow region of the upper limbs. Future research will focus on robot-based patient assessment methods. These techniques are usually carried out manually so an effective robot-based patient assessment technique could be beneficial in a non-specialised environment. Finally the project will also examine the phenomenon of slacking which is the natural tendency to try and minimise the amount of energy spent on a movement task which can compromise the effectiveness of robot administered therapy. Stephen is supervised by Professor David Kennedy and Dr. Nigel Kent.

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Space School

Eoin Murphy, PhD Student in Mechanical Engineering, will be the fourth DIT student to attend the International Space University's Space Studies Program based in Florida Tech and Kennedy Space Centre. He has received funding from DIT and has also been awarded a scholarship by the European Space Agency and Enterprise Ireland. Three other engineering students from DIT have previously attended the programme which in turn led to them taking part in a research project as part of the REXUS program, run by some of Europe's leading space agencies.

The 140 participants selected from companies and colleges worldwide attend core training modules in areas such as legal, engineering and life sciences linked to space habitation and exploration. They also complete team projects including the design of miniature rockets and production of reports on future space stations and space debris mitigation. Eoin's current studies on the flow of blood through coronary stents can also be applied to the design of life support systems for working in the harsh environment of space.

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Environment and Health

Report highlights effects of cold weather on the elderly

A study carried out by a group of researchers from Dublin Institute of Technology, the Institute of Public Health in Ireland (IPH), Northern Ireland Centre of Excellence in Public Health, and Brunel University London has shown that many older people forego other necessities in order to ensure that they can pay heating bills, and 24% of those surveyed said they found their homes too cold.

The research explored the experiences of a sample of 722 older people that were linked to a range of community and voluntary groups and services, (including Age Action, Energy Action, Rural Transport schemes and health and social housing service providers) and was funded by the Centre for Ageing Research and Development in Ireland (CARDI). The report was presented to the Minister for Communications, Energy and Natural Resources, Pat Rabbitte TD. Principal Investigator Professor Pat Goodman from Dublin Institute of Technology said: *"Winter mortality rates in both jurisdictions have decreased but there are still significant differences between winter and summer mortality rates in older people, and cold homes can contribute to this phenomenon".* Previous analysis, led by Dublin Institute of Technology, on cold-weather-related deaths in Dublin showed that each 1 degree Celsius drop in temperature was associated with a 2.6% increase in deaths over the subsequent 40 days, with the majority of these deaths occurring in older people.

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CARDI Director, Dr Roger O'Sullivan, Dr. Helen McAvoy, Senior Policy Adviser, Institute of Public Health (IPH), Professor Patrick Goodman, School of Physics, DIT; Minister for Communications, Energy and Natural Resources, Pat Rabbitte TD; Nicola Donnelly, CARDI.

New adjunct professor visits DIT

Professor William Miller, from University of Houston College of Optometry (UHCO), is the first Adjunct Professor to be appointed by DIT. Professor Miller, whose recent visit to Dublin coincided with the European Academy of Optometry & Optics Conference, delivered his inaugural lecture to final year students of Optometry on the subject of Contact Lens Fitting of Keratoconus. The 2012 conference of the European Academy of Optometry & Optics (EAOO) took place in Dublin for the first time. The conference sessions were hosted in the Croke Park Convention centre while the National Optometry Centre at DIT hosted the clinical workshops. The event was attended by more than 200 delegates from over 30 countries. Several members of the Department of Optometry at DIT made poster and oral presentations.

Professor Miller is pictured here with colleagues outside the National Optometry Centre, DIT: left to right, Professor Michael Devereux, Professor Ellen Hazelkorn, Declan Hovenden, Eva Doyle, Professor Miller, Dr. John Doran and Professor Brian Norton.

TCAS Online, a Hothouse graduate company was recently awarded the ICT Excellence Award 2012 for Best Start up Company of the Year. Pictured l to r Frank Quinn joint Managing Director TechCentral.ie, Shay O'Connor (COO), Barry Murphy (CEO).

Green light for first strategic development zone in Dublin city

An Bord Pleanála has given approval for the planning scheme for the new Grangegorman urban quarter in Dublin 7 which includes the new Environmental Health Sciences Institute (EHSI). The development, which will incorporate a major education and health campus, as well as sport, recreation and other public amenities, is the first to be approved as a Strategic Development Zone (SDZ) in Dublin City.

Michael Hand, CEO of the Grangegorman Development Agency (GDA), said the decision reflects the significance of the Grangegorman site and the surrounding area. Strategic Development Zone designation is available only to major projects which are deemed to have national social and economic importance.

He said *"This project will have a transformative effect on the city of Dublin, as well as contributing an employment stimulus to the construction industry in particular. It was important that the overall development was agreed from the outset to ensure that it is in keeping with the Development Plan for the city and so that everyone knew exactly what would be built on site."*

He continued *"Today's decision provides a planning framework for the development of this 73 acre site into the future and will contribute significantly to regeneration in this part of Dublin's city centre."*

The development will incorporate health facilities, a primary school, a public library and other amenities. It will become home to Dublin Institute of Technology (DIT), ultimately bringing over 20,000 students and staff to the campus. President of DIT, Professor Brian Norton said *"DIT is part of the fabric of Dublin city and we work closely with the communities around us. It is very important to us that our new campus will not only provide a leading edge educational environment for DIT students, but that it also contributes to the development of the city and its economy. Our primary role is to develop graduates who will contribute to building Ireland's future and this news is very positive for our future graduates."*

Professor Norton congratulated the GDA, the Agency charged with realising this vital regeneration of Dublin's north inner city, and the excellent design team of Moore Ruble Yudell and DMOD.

He said *"The quality of this project has been recognised by a number of major international awards already, including an Honour Award conferred by the American Institute of Architects just this week. Approval of the planning scheme ensures that the plan can be realised."*

Michael Hand said that following the An Bord Pleanála decision the project was now "shovel ready" and he was delighted to be able to say that an enabling programme of work can now start on site almost immediately.

He said *"The first tranche of work on site will include significant refurbishment of protected structures to bring them into educational use. While any stimulus in the construction sector is to be welcomed, the nature of this work is more labour intensive than new build and therefore delivers a bigger employment dividend, estimated at 500 man years. It is also very important work for the integrity of the site — the best way to preserve historic buildings is to occupy them!"*

Work is currently underway on construction of new mental health facilities on the North Circular Road side of the site and this is due to be finished by the end of this year. The next scheduled 'new build' will be the PRTLI-funded Environmental Health Sciences Institute (EHSI) and a design team has just been appointed. EHSI is a DIT-led initiative, in collaboration with Dublin City Council and the HSE, which aims to 'develop practical solutions to environmental health problems'.

www.dit.ie/about/grangegorman

Environment and Health

Energy research programme provides excellent employment opportunities

Over 80% of graduates of the School of Electrical Engineering System's unique post-graduate MSc degree in Energy Management obtain employment in the energy sector within one year of graduating. The programme was established in 2007 to help retrain graduates for the growing renewable energies industry and has over 100 registered students.

There is a wide range of subjects including mandatory topics such as organizational behaviour, financial modelling and energy supply. There are also optional modules on wind and wave energy, sustainable building design, power systems analysis and renewable energy technologies. Successful progression from the taught part of the course allows students to undertake a research thesis developed mainly in industry especially by those who are working and undertaking the programme on a part-time basis. The Programme is accredited with both the Energy Institute and the Chartered Management Institute so that graduates can become Chartered Engineers and Chartered Managers subject to their experience and employment status. Some of the graduates have decided to continue their studies and have registered with DIT for a PhD degree. In this sense, the programme is helping to bridge the gap between teaching, research and industry through the Dublin Energy Lab where many of the students are based. Working with Professor Jonathan Blackledge, Professor Eugene Coyle, Dr. Marek Rebow and Derek Kearney the areas of PhD research are: Wind Power Analysis using Non-Standard Statistical Models; The Impact of Wind Energy on Electricity Supply Sources and the Consequences for Gas and Electricity Markets; Simulation of Sea Surface Waves for the Evaluation of Wave Energy Conversion Technologies; Power Quality Estimation of Wave Energy Converters using Levy Statistics; Estimating the Wave Power Density of Ireland's Coastal Resource and Carbon Price Forecasting using a non-Gaussian Statistics.

Marc Lamphiere

One of these PhD students is Marc Lamphiere who graduated with an Honours Degree in Structural Engineering from Dublin Institute of Technology in 2004. After leading an engineering department within a multi-disciplinary consultancy firm as well as establishing his own practice he returned to complete the MSc in Energy Management in 2009. He subsequently graduated with a first class honours degree and achieved the highest mark in his graduating class.

His Masters research led to an invitation to present his work at the IBM Smarter Cities Seminar and he was subsequently nominated by IBM Dublin for the prestigious Worldwide IBM Fellowship Awards Programme. Marc is currently working on an Intelligent Energy Europe Research Project titled "The CORE Strategy — Carbon Zero and Renewable Energy" in the Dublin Energy Lab.

Marc's PhD thesis (Carbon Price Forecasting using a non-Gaussian Statistics) proposes an alternative risk assessment model for carbon and other energy commodities trading for investment signalling under the European Union Emissions Trading Scheme (EU ETS). He has already published in this area including a journal paper (Blackledge, J., Lamphiere, M., Panahi, A.: Computation of the Stochastic Volatility and Levy Index using the Kolmogorov-Feller Equation with Applications to Carbon Price Data Analysis. ISAST Trans. on Computing and Intelligent Systems, Vol 3, Issue 3, pages: 50 — 64. 2012).

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Fulbright award for DIT

Professor Eugene Coyle, Head of the School of Electrical Engineering Systems at DIT Kevin Street, was awarded the prestigious Fulbright Award in 2011 to work with a US University as a Fulbright Scholar.

Building on the successful collaboration which has been established in recent years between Dublin Institute of Technology and Purdue University College of Technology, he joined Purdue's Global Policy Research Institute (GPRI) for the academic year. He is researching energy and energy policy and crafting a book in partnership with Melissa Dark and an invited group of experts, principally centred at Purdue and Dublin Institute of Technology. They will be including senior policy advisors from both the United States and the European Union. The book will explore the co-relationship between energy and policy to endeavour to provide an understanding of energy policy and the integration of energy policy into engineering education.

"Energy has become a priority on a National and Global scale in engineering, science and across all the disciplines. People want to improve efficiency and reduce their CO^2 carbon footprint,' says Professor Coyle. 'The teaching of engineering has experienced a number of changes in recent years. New modules now incorporate renewable energies, energy efficiency and subjects like power quality. This applies to electrical engineering but it also applies across the sphere of engineering including civil engineering, mechanical engineering and building services. There is a greater integration now between science and the social sciences."

"DIT has a strong and fruitful relationship with Purdue University. A number of exchanges have taken place by presidents of both Institutes as well as the academic staff in both. We also have an EU US collaborative exchange programme for our students similar to Erasmus in Europe."

"Engineering Ireland informs us of the criteria for our programmes. So I need to have my engineering programmes here in the school of electrical engineering, accredited by professional bodies. Every five years we have a review for our programmes during which we are informed by the criteria from those bodies as to how we should teach. In the past, it was very mathematical but increasingly the criteria extend very much into ethics, interpersonal skills, professional conduct and teamwork."

Professor Eugene Coyle, Professor Jonathan Blackledge and Professor Brian Norton.

Topics under review in the course of his Fulbright research include increasing greenhouse gas emissions to the atmosphere and ensuing climatic effects, energy policy and its place in engineering education, and energy demand and continued world dependence on fossil fuel energy sources. In thinking forward we also look back for remindful lessons from both our engineering successes and failures.

In this book a review of historical landmark achievements in technology will be carried out together with a counter critique of negative consequential re[illegible]s from otherwise successful technological innovations. We question what lessons can be learned from past mistakes. A review of both policy and developments in renewable technologies and clean technologies, including future prospects for wide-scale deployment of solar, wind, marine, and biomass, likely in tandem with nuclear energy, and development of smart interconnecting supergrids, is being made. It is envisaged that such grids will facilitate clean energy transportation between nations and across continents.

"The book will inform everybody including Government Departments themselves. Academics will be able to see what we are doing at DIT and I will provide information that will help people and direct them towards doing something similar."

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Information and Media Technologies

Unravelling the secrets of code

In October 2011, Stokes Professor Jonathan Blackledge gave a series of seminars and short courses at the Centre for Advanced Studies (CAS), Warsaw University of Technology (WUT) as part of his role as Distinguished Professor at WUT. The activity is part of a wider collaboration in teaching and research between DIT and WUT established by Dr. Marek Rebow, Head of Research for the College of Engineering and Built Environment and a doctoral graduate of WUT. The courses included Medical Imaging, Computational Finance and Algorithmic Trading and Information and Communications Security. Professor Blackledge was also asked to put together a CAS textbook for the Information and Communications Security course and this has now been published.

Cryptography and Steganography: New Algorithms and Applications (ISBN 978-83-61993-05-6, 2011) is edited by Professor Stanisław Janeczko who heads the CAS and is Director of the Institute of Mathematics at the Polish Academy of Sciences. The book provides an account of how algorithms can be designed to both encrypt and hide information. However, the book also attempts to give a historical account of cryptography and includes some of the more important milestones in the development of the subject such as the work of the Polish Cipher Office in the 1930s which helped the British to crack the German Enigma traffic during the Second World War.

The Earl Kitchener of Khartoum provided the forward

My introduction to information security began in the Second World War when I was a communications officer in the Royal Signal Corps. At that time, the pioneering work being undertaken in Station X at Bletchley Park to decipher the Enigma codes was, as Winston Churchill rightly called it, an Ultra-secret. Since that time, the methods and technologies associated with securing information have developed rapidly, made practically viable through one of the great inventions pioneered at Bletchley Park, namely, the (partially) programmable computer — Colossus. However, although the engineering associated with information and communications technology in general has and continues to undergo radical change many of the underlying mathematical principles remain the same. This book explores ways in which chaos can now be used to construct a new generation of powerful encryption engines and then disguise their outputs in a range of data types.'

Above, Professor Blackledge at the memorial in Natolin, (south) Warsaw, where the first routine decrypts of the German Enigma encrypting machine were undertaken by Marian Rajewski, Jerzy Rozycki and Henryk Zygalski in the mid 1930s. This activity followed on from the success of the first Polish Cipher Office established by the Department of Mathematics at the University of Poznan in 1929.

In his book A Mathematician's Apology G H Hardy wrote that there were 'no interesting applications of pure mathematics'. This is no longer true and Professor Blackledge's book on Cryptography and Steganography is a fascinating example of how the mathematics associated with nonlinear systems and signals can be used to develop new algorithms and applications in an area that is vital to information and communications security'.

A DIT internal e-version of the book is available at http://eleceng.dit.ie/papers/195.pdf and the associated short course entitled Information and Communications Security 10 — 14 October, 2011 is available at http://jmblackledge.web.officelive.com/ShortCourses.aspx

Information and Media Technologies

Novel technology to detect fraud

Product counterfeiting is a worldwide problem which costs companies and governments billions in revenue every year with the loss of sales and tax income. Counterfeit goods are not only inferior in quality but may also be a risk to consumers as the number of dangerous products on the market increases.

The pharmaceutical industry is particularly susceptible to counterfeiting. According to the World Health Organisation an estimated 10% of drugs worldwide are counterfeit costing the industry approximately $40 billion per year and some of these have even caused fatalities.

The industry is continuously increasing measures against counterfeiting and the introduction of new regulations such as the Falsified Medicines Directive has led to the need for improved traceability and authentication of products.

Holograms are a well accepted authentication device, but existing holograms are always identical to one another and don't have any individual features that could be used for further verification. This is because traditionally holograms are mass produced from an expensive 'master' hologram and hence it is not commercially viable to individualise them. The typical holograms a consumer sees applied to packaging are identical for each product range. These are quite easy for the counterfeiter to replicate and may not provide sufficient protection.

Now, DIT's Centre for Industrial and Engineering Optics (IEO) has developed a novel hologram production technique which allows the mass production of individualised holograms.

The IEO research team, under the lead of Principal Investigator Dr. Izabela Naydenova is currently assessing the commercial feasibility of creating a spin out for this novel technology which will have a significant impact on counterfeit prevention.

The work is being carried out with funding from Enterprise Ireland's commercialisation fund. The team's mentor, Gerard Molloy (Sales Director of Label Art, Dublin) was introduced to the team by Enterprise Ireland's commercialisation specialists and is providing guidance and commercial expertise to the project.

The technical work is being carried out in IEO's printing and optical laboratories in DIT's FOCAS Institute. Every aspect of the hologram's production is being developed from preparation to exposure to protection. Interaction with potential customers and commercial partners is an important part of this work and the team frequently visit relevant companies to take into account their particular requirements and details of their production processes. Industry feedback has been extremely positive and the product is expected to have significant potential in the fight against counterfeiting.

With this product consumers will be able to check the authenticity of the product they have purchased. A unique holographic code on a transparent film will be placed on the packaging of each product. When you remove and hold it up to a light source you will be able to see the code which can then be verified against a code written on the packaging. Alternatively using a web based or smart phone application or a text message you can verify the product is the genuine article. As each code is unique counterfeiters will not be able to reproduce it.

The team is working with industry partners to optimise prototypes and finalise the mass production processes and hopes to form a spin-out company in the very near future.

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Society, Culture and Enterprise

Irish researchers brief House of Commons

Three Irish academics were invited to Westminster in April to brief the Political and Constitutional Reform Committee of the House of Commons on their research into international lobbying regulations. Dr. John Hogan (DIT, pictured above), Professor Raj Chari (TCD) and Professor Gary Murphy (DCU) are joint authors of Regulating Lobbying: A Global Comparison (published by Manchester University Press).

The Political and Constitutional Reform Committee is charged with reviewing issues surrounding the introduction of a lobbyist register in the UK. The issue is of considerable public interest, given the forthcoming legislation and the high profile Levenson Enquiry. While Professor Murphy was unavailable, Professor Chari and Dr. Hogan attended the Committee session. In their submission, they spoke to the Committee about their research findings which offer a means for benchmarking potential regulatory regimes. The session was broadcast live on the House of Commons television channel and an audio recording is available on **www.parliamentlive.tv.** The research undertaken by Dr. Hogan, Professor Chari and Dr. Murphy was funded by the Irish Research Council for the Humanities and Social Sciences (IRCHSS). On previous occasions they have presented their findings on lobbying regulations internationally to members of parliament in the Czech Republic and to members of the Oireachtas in Ireland. They are currently consulting with the Government Reform Unit of the Department of Public Expenditure and Reform in relation to the introduction of a lobbying register in Ireland by 2013.

Dr. John Hogan lectures in the College of Business, DIT; Professor Raj Chari is a lecturer in the Department of Political Science, TCD; and Professor Gary Murphy is Associate Professor in the School of Law and Government, DCU. Their 'Regulate Lobbying' website can be accessed at http://regulatelobbying.com

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Paper nominated for top award

The Strategic Management Society is the world's leading strategic management association with over 2,500 members in 60 countries, and its official publication, the Strategic Management Journal, is consistently rated as one of the top publications in the management arena.

A recent paper submitted by PhD student Marty Reilly, College of Business, and his co-supervisors, (Dr. Pamela Sharkey Scott, Research Fellow, DIT College of Business and Professor Vincent Management, E.M. Grenoble) has been nominated for the SMS Best Conference Paper Prize, to be judged at the annual conference being held later in the year in Prague. Over 1,100 papers were originally submitted. The title of the paper is: 'Navigating in the Modern MNC: The Emergence of a Pilot Subsidiary Role'.

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Society, Culture and Enterprise

Upgrading local authority housing through 'Lean'

Daniel O'Neill, PhD student, DIT Bolton St, is conducting research into the use of 'Lean' as a method of managing the upgrade of Dublin City's local authority housing. Lean is centred on the principle of 'preserving value with less work' and has the goal of reducing costs. He is conducting the research under the supervision of Dr. Louis Gunnigan and Peter Clarke who bring their expertise in construction procurement and building technology to the project.

Daniel's research started off as an MPhil project in December 2009. He researched construction technology, management and the cost of maintaining the housing stock, before focusing on the cost of upgrading it. Lean was chosen as the philosophy best suited to cost-effective upgrading of the housing stock.

In September 2011 his first paper was submitted to the University of Salford International Postgraduate Research Conference. The conference had a number of papers relating to the topic of housing. The paper's title focused on what is now the title of his PhD research: "Reducing the cost of upgrading Dublin City's local authority housing built prior to the introduction of the 1991 building regulations, through lean thinking/lean construction."

The paper won the conference award for best industry-focused research. This has been downloaded by researchers around the world from Arrow, DIT's research repository. The paper outlined the research which was undertaken between late 2009 and mid-2011. This period of research examined a number of areas such as the history of the housing stock; original construction technology of the housing stock; upgrade programmes undertaken in the Republic of Ireland; and comparisons with the UK on the successes and failures of upgrade programmes undertaken there over the past decade. He is currently developing a Lean Procurement Framework for the cost efficient upgrade of the housing stock.

This framework will be applied to energy upgrading however the framework will be flexible and in time may be applied to other upgrade programmes and by other large municipal councils. His research is generating a lot of interest from researchers and companies in mainland Europe and the United Kingdom.

In 2013 two more research papers will be developed focusing on two separate areas which have arisen while researching the main topic. These papers will be submitted to international conferences. A journal paper on the overall area of research will also be prepared in 2013 to be submitted for publication in 2013—2014. The research project was originally looking at the "bricks and mortar" management of the housing stock, but over the past two years has developed to focus on housing management/maintenance form the interface of construction and social anthropology.

His Lean Procurement Framework will be tested by a focus group in DIT Bolton Street at the end of November 2012. The focus group will comprise members with backgrounds in politics, economics, social studies, technology, environmental science, and law.

Dublin City Council has provided a lot of useful information for Daniel's research. The Housing Department has supplied information on the housing stock and the Quantity Surveyors Division has provided information on the cost of upgrade works. A number of schools in the Bolton Street and Kevin Street campuses have also provided helpful technical information. Academic staff members at University of Salford have provided useful information on UK social housing and Lean. Daniel hopes to work in the social housing sector in the UK after he completes his PhD and will continue to write on the topics of housing, construction procurement and Lean.

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Information and Media Technologies

IEO developing novel technology for over 20 years

The Centre for Industrial and Engineering Optics in DIT Kevin Street, and the holography group that it evolved from, has been working on novel photopolymer materials and their applications for more than two decades. Over this time span the research has evolved from separate postgraduate projects in photopolymer development and interferometric metrology systems into a range of applications-oriented projects that exploit the various technologies that have been developed in the centre. The centre strives to strategically balance academic research with industrial applications and is continuously seeking out new opportunities to collaborate with industry and other academics in developing holographic systems and materials.

Much of the Centre's current research focuses on the unique photopolymer developed by IEO, and a great deal of the basic material and systems development is carried out by postgraduate research students. Currently the group has five graduate students. Dervil Cody is improving the photopolymer using non-toxic monomers and Mohesh Moothchancery has been carrying out studies on the fundamental properties of the photopolymer such as shrinkage.

Hoda Akbari is developing applications in diffractive elements made in the photopolymer, Denis Bade is developing unique holographic data writing systems and Viswanath Bavigadda has just completed his PhD thesis on interferometry using holographic elements. Niamh Ingoldsby is doing a graduate placement at the centre investigating speckle interferometry and the group has just heard that Tatsiana Mikulchyk, who spent nine months in graduate placement with IEO in 2011, has been awarded an IRCSET postgraduate scholarship to re-join the group in September 2012.

Recent PhD graduates are working in a range of optics-related industries in different locations around the world including Singapore, India and the Netherlands. IEO postgraduate students have been very successful in presenting their research at both European and International Conferences and have contributed to the IEO's portfolio of 33 peer reviewed journals published within the past 5 years (**www.arrow.dit.ie**).

The centre also facilitates around six undergraduate degree and summer projects/placements per year and is increasing the direct input of research activity into the undergraduate curriculum. For example a Level 10 module in 'Holography: Techniques and Application' and a Level 8 module in 'Invention, Innovation and Commercialization' have been developed.

Current undergraduate students are David Houze from the University of Bordeaux, and two students from the Industrial and Environmental Science degree programme delivered by DIT's School of Physics (Ciara Farrell and Loïc Saint-Marcel). Andrew Ryan from the Physics Technology Programme and Aodh MacGairbhith from Science with Nano-Technology also completed their final year undergraduate project with IEO.

IEO staff are developing a number of key applications that have commercial potential in security and sensing, and devices. For example, Dr. Izabela Naydenova is developing sensing applications for photopolymer gratings, security holograms with unique identifiers and printable diffractive devices. A pressure sensitive version of the hologram which changes colour with pressure is under development by Dr. Emilia Mihaylova and this has interesting applications where contact pressure needs to be measured.

Dr. Suzanne Martin is developing holographic diffractive devices with applications in light manipulation and distribution and investigating moisture sensitive systems. Professor Vincent Toal's key area of expertise is in interferometric systems and classic holography. He recently published a textbook on holography 'Introduction to Holography' (published by CRC Press), which has been very well received by academics around the world.

The IEO team believe that collaboration with other disciplines and Institutes is essential to their mission to combine academic achievement and development of commercial technologies. Within DIT, the Centre is working with the Dublin Energy Lab on holographic optical elements for applications in solar collectors and the School of Manufacturing and Design Engineering in the area of optical system design.

Most postgraduate students in the Centre spend at least a few months abroad gaining experience at the laboratories of one of the IEO centre's international partners including the University of Caen in northern France, Joint Research Centre at Ispra in northern Italy, Hololab at the University of Liege in Belgium and the Institute of Optical Materials and Technologies at the Bulgarian Academy of Science.

Recently IEO's unique photopolymer has also opened up many exciting commercial opportunities and Amanda Creane is helping the team to exploit these. The PIRA report 'Ten year forecasts of disruptive technologies in security printing, 2010' forecasts that photopolymer holograms will be the number one disruptive technology in security printing in the next ten years, primarily because of their visual appearance and difficult-to-copy volume fringes. IEO's commercialisation activities are currently focused on this application for their technology and with 5 patents applied for since 2005, IEO continues to work with Hothouse and Enterprise Ireland on spin out and licensing opportunities.

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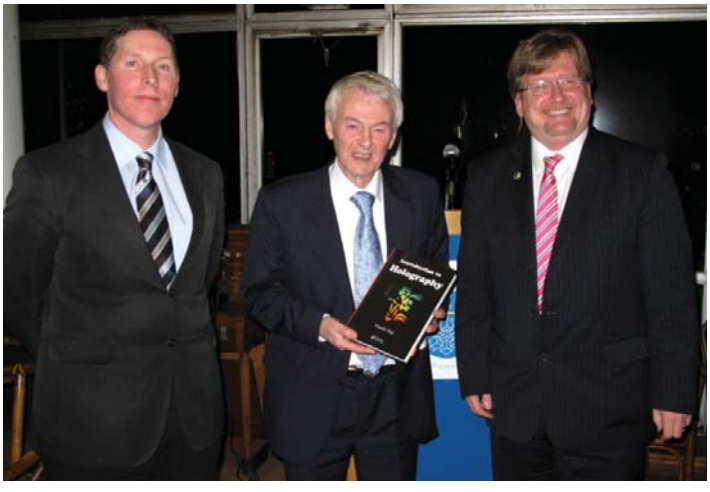

Professor Vincent Toal launches new holography textbook

A new textbook, An Introduction to Holography by Vincent Toal, was launched recently at a reception in Dublin Institute of Technology, Kevin Street by the President of DIT, Professor Brian Norton.

Congratulating Professor Toal on the publication of Introduction to Holography, Professor Norton described it as a seminal textbook and an admirable legacy for someone who has been at the forefront of education in Physics for many years. Referring to the quote from Wittgenstein at the front of the book, that "Explanations come to an end somewhere", Professor Norton said that this book will in fact be the beginning for other's work.

"To quote Isaac Newton, "If I ha[illegible]een a little further it is by standing on the shoulders of Giants", Professor Toal's work will provide just such a vantage point to future students. The clarity of his explanations and the simplici[illegible] the presentation is really thrilling. Vincent has published widely throughout his career but this book offers a more rounded exposition of his very considerable knowledge and expertise than is perhaps possible in individual research papers. My wish is that this book gets the readership that it most certainly deserves."

Professor Toal acknowledged the President's remarks and paid tribute to his colleagues for their support — in particular to Dr. Suzanne Martin, manager of the Centre for Industrial and Engineering Optics (IEO), Dr. Izabela Naydenova in the School of Physics, and the excellent library staff in DIT. Enthusing about his subject, he said he had written the book for advanced undergraduate and graduate students, including those contemplating a research career as well as for more experienced scientists and engineers considering the application of holographic techniques to the solution of specific problems in widely diverse fields. Introduction to Holography by Vincent Toal is published by CRC press, an imprint of the Taylor & Francis Group.

Pictured at the launch l to r Dr John Doran, Professor Vincent Toal, Professor Brian Norton

Society, Culture and Enterprise

Talking about punishment

Dr. Mary Rogan, Lecturer in Socio-Legal Studies at the School of Social Sciences and Law has been funded by the Irish Research Council for the Humanities and Social Sciences under its Research Development Initiative for a project which plans to increase the understanding of prisoner's rights among prisoners, their families, legal professionals and policy-makers.

'Talking about Punishment' is being run in collaboration with the Irish Penal Reform Trust — Ireland's leading non-Governmental organisation campaigning for the rights of people in prison and the reform of penal policy. Under domestic and international law prisoners retain rights which are not inconsistent with imprisonment itself. However, while there is formal legal recognition of these rights there are many hurdles to be overcome. One of these is the lack of understanding of prisoners' rights and how they can be vindicated.

To address this problem the researchers created a booklet for prisoners with information about their entitlements to healthcare, visits and legal advice while in prison. The booklet also distils case law from Irish and European Courts of Human Rights in particular with regard to the right to bodily integrity and freedom from inhuman and degrading treatment. The constitutional and human rights implications of issues such as slopping out and overcrowding are also examined. Prisoners are informed about means of redress if they feel their rights have been infringed.

This booklet was produced in collaboration with the Irish Council for Civil Liberties which has a 'Know Your Rights' series, designed to provide comprehensible and straight-forward explanations of rights in a variety of situations e.g. when dealing with the police.

The project will also create an information brochure for the families of prisoners on their rights when a prisoner dies and what they can expect to happen in terms of investigations and inquiries.

Prisoner's rights under Irish Law

"There are many issues within our prison system that give rise to potential breaches of constitutional rights and rights under the European Convention on Human Rights' says Dr. Rogan. *'Slopping out, overcrowding and the lack of an independent complaints mechanism for investigating prisoner's complaints or deaths in prisons are all issues of concern that may lead to litigation.*

Despite the Irish courts taking an expansive approach to prisoner's rights, it has been reiterated in a number of cases that they retain rights which are not incompatible with the realities of imprisonment. The courts have held that a prisoner does have a right to bodily integrity and a right not to have his or health exposed to risk or danger.

However, both rights must be subject to limitations and the interpretation has been that the rights of prisoners are limited by considerations of practicality, the common good or the protection of the prisoner. The Supreme Court has gone further holding that many of a prisoner's normal constitutional rights are abrogated or suspended during the period of imprisonment. However, McKechnie J in Holland v Governor of Portlaoise Prison held that a prisoner should suffer restrictions on rights other than the right to liberty only to the extent necessary to accommodate the serving of the sentence.

While the courts have recognised that prisoners have a right not to be exposed to inhuman or degrading treatment, in the past they have also held that in order to establish a violation of that right it must be established that there was an 'evil purpose' on the part of the prison authorities or that the restrictions and privations on detention were punitive or malicious. Recently, however, two judgments of the High Court were delivered which are of major significance to Irish prison law and prisoner's rights and which illustrate the very difficult position with some of our prisons. The first, Mulligan concerned a prisoner in Portlaoise Prison who alleged his constitutional rights and rights under the European Convention on Human Rights had been breached because of the absence of in-cell sanitation, unhygienic conditions and the need to 'slop out' (ie to dispose of human waste in a receptacle placed in the prison cell).

MacMenamin J held that no such breach had occurred on the basis, inter alia, that the applicant had been in a single cell, had a good amount of out of cell time and access to workshops and other facilities which outweighed the negative aspects of the conditions. Though the prisoner failed in that case, the judgment leaves open the possibility of a successful claim by those required to slop out in overcrowded conditions in the presence of others.

Society, Culture and Enterprise

In June 2011 the case of Kinsella v Governor of Mountjoy Prison was decided by Hogan J. The applicant was seeking release from detention under Article 40.4 of the Constitution on the basis that his constitutional rights had been breached to the extent that he was no longer in lawful detention in Mountjoy Prison. The applicant had spent 11 days in a padded cell with a cardboard box provided as a form of sanitation facility in conditions held to have amounted to a form of sensory deprivation.

The court held that these conditions had breached his right to bodily integrity, but were not such as to require immediate release as the prison authorities had not been motivated by ill-will or malice towards the prisoner. Following the decision the prisoner was transferred out of Mountjoy Prison. This significant decision may indicate a greater readiness on the part of the courts to find breaches of constitutional rights in the future.

Barriers to vindicating rights

While the judgment in Kinsella may signal more willingness by the Courts to intervene in prison conditions to protect the rights of prisoners, if the prisoners don't understand the rights that they have, any statement in relation to these by the courts remains illusory and the possibility of taking actions is limited.

The historical lack of prisoner's rights cases in Ireland is also due to the small numbers of cases being taken. One of the reasons is that many of those in Irish prisons are sentenced for very short periods of time. In 2009, 62% of all those sent to prison received sentences of less than six months (Irish Prison Service, 2010). This group are unlikely to engage in litigation which can be very time-consuming (running possibly to many years) and has limited potential to change the conditions in which they are currently living.

The Irish prison population, like most prison populations across the world, is characterised by socio-economic disadvantage and poor educational attainment. Although data is limited, a small number of studies have shown us that prisoners tend to have left school early without sitting any public examinations (O'Donnell, Hughes, & Baumer, 2009; O'Mahony, 1997). Many have experienced homelessness prior to committal (as found by research carried out in Dublin Institute of Technology) (Seymour, 2005) and the prevalence of mental illness is high (Duffy, Linehan, & Kennedy, 2006). Added to this is the widespread use of drugs and drug addiction, with Lyons et al finding that use of injected drugs was 'endemic' within Irish prisons (Lyons, Walshe, Lynn, & Long, 2010). All of these factors militate against cases being litigated by prisoners.

Another factor lies within the legal profession itself. Prison litigation is often time consuming and difficult, with limited prospects of being paid for the work. There are many barriers to public interest litigation in Ireland, including the lack of provision to take class actions i.e. cases which are taken on behalf of many prisoners. In Ireland, cases are taken on behalf of individual prisoners, meaning that prison law changes incrementally.

Society, Culture and Enterprise

In addition to these barriers, the lack of prison law research capacity among lawyers is a further significant restraint on action. This project also aims to educate lawyers on prison law jurisprudence by creating research materials on what Irish and European Conventions on Human Rights law say about prison conditions, about how to litigate prison issues and about accountability mechanisms in prison. Allied to this, the Department of Law has recently validated a module on Prison Law and Prisoner's Rights which will increase awareness and develop skills in prison law among the lawyers of the future. Dublin Institute of Technology will be at the forefront of legal education in Ireland in this regard.

Finally, to address the barriers to litigation at the level of policy the project will deliver a briefing paper and seminar to policy-makers about how the issues might be addressed through legislative or policy change.

When writing the funding proposal, Dr. Rogan considered that this approach of providing materials to prisoners, their families, legal professionals and policy-makers would provide the best means of meeting her objectives. She hopes that this practical approach will improve prisoners' understanding of their rights and how to vindicate them and that this increased awareness can be responded to appropriately by informed legal professionals.

Knowledge exchange

This project is also an example of the growing interest in 'knowledge exchange activities' or community-based research. In this case, academic legal research on the Irish and European Conventions on Human Rights approaches to prisoner's rights has been brought to audiences outside of the academic community and, arguably, to those most affected by the principles discussed within that community.

Through this project, it is hoped that legal scholarship can be made accessible to those most directly affected by it.

The project's name: 'Talking about Punishment' reflects its desire to encourage greater discussion, awareness and ultimately respect for the rights of those in prison and was inspired by a book called 'Thinking about Punishment' by Professor Michael Tonry, an eminent American criminologist who is also legally trained (Tonry, 2009). Dr. Rogan also hopes that her project will enrich the School of Social Sciences and Law's commitment to developing a better understanding of the role of law in society and the impact of law on personal and social lives, particularly in places most hidden from public view.

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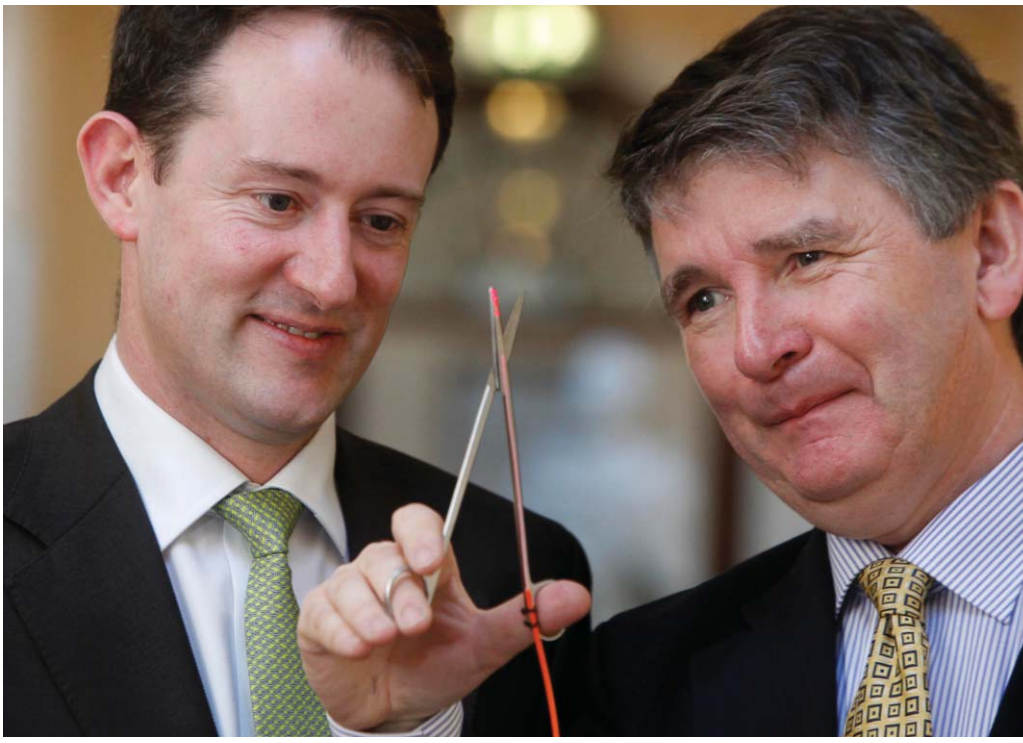
New Materials and Technologies

SFI TIDA awards for DIT researchers



Science Foundation Ireland (SFI) awarded almost €300k in three separate awards to DIT researchers working in the Photonics Research Centre (PRC) and in CREST — the Centre for Research in Engineering Surface Technology.

SFI in collaboration with Enterprise Ireland (EI) fund the TIDA Feasibility Study Award. This prestigious award is intended to fund commercially relevant applied research programmes. It enables researchers to focus on the first steps of an applied research project which, if further developed, has potential to be a commercial success. A Feasibility Study award is usually up to a maximum of €100,000 and covers direct costs for a period of 12 months.

The DIT award winners, and their research areas are:

Optical acoustic sensing based on an SMS fibre structure, Dr. Qiang Wu, Photonics Research Centre.

Sensorized Intra-luminal Staplers for laparoscopic Surgical Anastomosis, Professor Gerald Farrell and Dr. Ginu Rajan, Photonics Research Centre

Controlled Oxidation of Adsorbable Magnesium Stents, Dr. Brendan Duffy, Senior Research Manager, CREST

The Photonics Research Centre in DIT undertakes research in photonics, with a particular emphasis on optical sensing. The Centre is located in the School of Electronic and Communications Engineering and is led by its Director, Professor Gerald Farrell and Principal Investigator, Yuliya Semenova. They are supported by a multi-national team of senior and post-doctoral researchers and doctoral graduate students.

DIT CREST is the leading surface coatings and corrosion control laboratory in Ireland. Dr. Duffy, along with four of his colleagues was also recently presented with commercialisation awards by DIT and Enterprise Ireland for four individual licences:

Brendan Duffy, John Colreavy, Hugh Hayden and Rajath Varma for licensing anti-corrosion coatings to C&F Automotive.

Michael Whelan, John Colreavy and Hugh Hayden for licensing anti-bacterial coating for joinery products to Gem Group.

John Colreavy, Michael Whelan and Hugh Hayden for licensing anti-bacterial coatings for glass to Smartglass International Ltd.

Hugh Hayden, John Colreavy and Michael Whelan for licensing anti-bacterial coatings for stainless steel products to Yoruba Ltd.

Minister for Research and Innovation, Seán Sherlock TD and TIDA award recipient Professor Gerald Farrell, Dublin Institute of Technology.

An interdisciplinary and cross-sectoral approach to research

In December 2011 Dr. Noreen Layden joined DIT as Head of the Environmental Health Sciences Institute (EHSI), a new dedicated institute for inter-disciplinary research. Dr. Layden has a strong academic background that includes an MSc and PhD in Environmental Sciences. She worked in the private sector in regulatory compliance and environmental consultancy where she managed environmental impact assessments and implemented quality and environmental management systems. Prior to joining DIT, Dr. Layden worked as Program Director for Environmental Engineering at the University of California Berkeley, USA where she designed and developed programs in environmental science and engineering

The Environmental Health Sciences Institute (EHSI) is a dedicated national translational research platform, uniquely based on collaboration between the Dublin Institute of Technology (DIT), the Health Service Executive (HSE) and Dublin City Council (DCC). EHSI forges new ground in understanding the interactions between environment and health and builds national and regional capacity and capability, developing evidence-based interventions addressing environmental health problems. EHSI is an all-island initiative, involving strategic partnerships with the University of Ulster, Dublin City University (DCU), the Institute of Public Health (IPH) and other stakeholders. It is uniquely positioned to facilitate an interdisciplinary and cross-sectoral approach, integrating academic research with the knowledge and expertise of relevant professionals to generate collective responses to public health threats.

Recently, An Bord Pleanála approved the planning scheme for DIT's new development, which will incorporate a major education and health campus, as well as sport, recreation and other public amenities. Ultimately, Dublin Institute of Technology (DIT) will be consolidated there, bringing over 20,000 students and staff to the campus. The first step is building a new state-of the art, dedicated research facility for the Environmental Health Sciences Institute (EHSI) (2500m^2). EHSI will be central to DIT's research hub on the Grangegorman campus and it will complement the HSE's existing health facilities already there. Work is currently underway and the new building is targeted for occupation in 2015.

EHSI is a novel, progressive approach to bridging the science-innovation-policy gap, reviewed and validated by an international panel of experts via the PRLTI-Cycle 5 funding protocol. The establishment and overall development of EHSI is overseen by a Board of Governors comprising senior representatives from business (IBEC), health agencies (HSE, IPH), academia (DIT, UU) and government agencies (EPA, DCC). Through strategic partnerships and collaboration with multi-sector stakeholders, EHSI is responding to environmental health research needs despite current resource constraints and prevailing economic circumstances. Central to EHSI's mission is an interdisciplinary and cross-sectoral approach, focused on generating collective responses to public health threats. This is achieved through collaboration between teams of Environmental Health Academics and Practitioners (EHAPs) which leverage the collective expertise of relevant academics, health practitioners and policy makers to determine and manage the solution focused research agenda to yield superior outcomes and benefits (e.g. economic; policy; new information/data; new technology).

Interdisciplinary teams pursue specific areas of research focus (SARF's) to provide the evidence base and appropriate interventions including: Water Quality, Bio-monitoring, Energy, Food Quality & Safety and Policy/Social Sciences. EHSI's research is underpinned by Cross-cutting Research Activities (CCRA's): Teaching, Learning & Outreach; Technology Development & Commercialisation (e.g. Hygiene & Infection Control; Assistive Technology; Monitoring; Healthcare Technologies) and Maths & Computational Methods. EHSI's overarching mission and vision is to achieve Healthier Lives for Children, the Elderly and Vulnerable Populations.

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innovation@dit

where science meets industry

3-7pm on Tuesday, 19th June 2012 in the Aungier Street campus

Official opening: Séan Sherlock, TD, Minister for Research & Innovation

Our DIT research community is developing innovative solutions to next generation problems and translating research into new products, processes and policies.

Examples include: new cancer diagnostic tests; anti-bacterial surface materials; mobile phone applications; metal-based anti-cancer compounds; novel financial risk management tools.

Last year, one in every five commercial licences generated by Ireland's higher education sector was secured by DIT through commercialising its research.

Innovation @ DIT will showcase current industry-focused research in areas such as:

New Materials and Technologies

- nanotechnology, photonics, inorganic pharma and nanomaterials

Information and Media Technologies

- antennas, digital media and electrical power

Environment and Health

- food, water quality, energy and bio-monitoring

Society, Culture and Enterprise

- creative industries and entrepreneurship

View the exhibition, meet the researchers, see the technology and talk to experts from Enterprise Ireland, SFI, IUA and IRCSET about national and European research funding opportunities.

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Further information about the Innovation Showcase is available at:

http://ditinnovation.eventbrite.ie

Department of Mechanical Engineering ,Dublin Institute of Technology, Bolton St

Master of Engineering (ME) in Mechanical Engineering

The Department of Mechanical Engineering at the Dublin Institute of Technology offers a Level 9 taught Master of Engineering (ME) in Mechanical Engineering. This masters programme can be taken on a one-year full-time (DT087) or two/three-year part-time (DT088) basis and consists of twelve taught modules and a Research Project module. The full list of modules is:

1. Entrepreneurship for Engineers
2. Innovation and Knowledge Management
3. Research Methods
4. Applied Surface Engineering
5. Statistical Analysis for Engineers
6. Finite Element Analysis
7. Advanced Dynamics with Applied Computer Modelling
8. Computational Fluid Dynamics
9. Heat and Mass Transfer
10. Sustainable Energy Systems
11. Renewable and Alternative Energy Technologies
12. Biomechanics
13. Research Project

Details of how to apply and the programme fees can be found at the following address:
www.dit.ie/postgrad

Further information is available from:

Dr. Fergal Boyle, Programme Chair,
Tel: 01-4023813, E-mail: fergal.boyle@dit.ie

Prof. David Kennedy, Head of Department,
Tel: 01-4023846, E-mail: david.kennedy@dit.ie

The deadline for the receipt of applications is July 27th 2012.