2010-3

ResearchNews, Issue 4, March 2010

Dublin Institute of Technology

Issue 4 | March 2010

Dublin Institute of Technology

ResearchNews

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Editorial

According to the OECD, 'Governments can help prime the engine for long-term growth by channelling crisis funds to research and development, entrepreneurs and education'.

This was brought home to me at the recent launch of IMAAS (Interactive Music Access and Archive System). This project, which is a collaborative effort between the DIT Audio Research Group, Cork Institute of Technology and the Irish Traditional Music Archive, has already produced licensed technologies. IMAAS is the fruit of ten years of research investment. It was brought together by musicians, designers, signal processing engineers and digital programmers.

A parallel project brought together linguists, programmers, signal processing engineers and designers to develop a suite of computer-aided English language learning tools for Chinese speakers. A contract has just been signed with Cambridge University Press.

Over the years, both projects have won competitive funding from the Department of Education and Science, Enterprise Ireland, the EU, Arts Council, IRCSET, SFI and industry. Academic partners come from Spain, the UK, Finland and Germany, and many of the industrial partners have come back to DIT on other projects.

DIT has established a strong track record in use-inspired research. DIT Technology Transfer outperforms, by a factor of 4, typical European/US university competitors. In 2009 alone there were 44 invention disclosures, 6 patents filed, 12 licenses and 2 start-up companies. DIT is ranked within the top 3% of world universities according to the QS Top Universities Ranking, 2009.

The lesson to be drawn is that research is a long term investment. Ireland's future depends on making sustained long term investment across the full range of disciplines to ensure that the knowledge society has the human capital it requires.

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

[Information & Communications Technologies]

ENCRYPTION SECURITY RESEARCH GROUP

The Information and Communications Security Research Group is based in DIT's School of Electrical Engineering Systems. The research group is headed by Professor Eugene Coyle and is under the technical direction of SFI Stokes Professor J M Blackledge. Professor Blackledge has over ten years industry experience in this area including work undertaken for the Bank of England, GCHQ, Giesecke & Devrient GmbH and Microsharp Corporation where he was formerly Director of R&D.

Along with applied and academic research, the group also engages in consultancy and industry collaboration and has a range of proprietary technologies available for license. Research interests and expertise include the following:

- **Data encryption using novel algorithms**
- **Information hiding and Steganography**
- **Data authentication**
- **Printed document authentication using texture coding**
- **Forensically inert software engineering**
- **Covert encryption methods**
- **Management of encrypted information**
- **Software solutions for security applications**
- **Network security**
- **Digital rights management**

The group was established earlier in the year as part of the SFI Stokes Professorship programme and has already recruited a number of overseas PhD research students to work under the supervision of Professor Blackledge. In this article Professor Blackledge describes his new method of hiding encrypted information in digital signals and images.

What's wrong with an encrypted file?

What is wrong is that it flags the fact that the file may contain sensitive information otherwise why bother encrypting it?

One of the principal weaknesses of all encryption systems is that the form of the output data — the 'ciphertext' — alerts an interceptor to the fact that the information being transmitted is important and that it is therefore worth 'attacking' and attempting to decrypt it. This aspect of ciphertext transmission can be used to propagate disinformation, achieved by encrypting information that is specifically designed to be intercepted and decrypted.

In addition to providing an 'interceptor' with a 'honey-pot' designed to propagate disinformation, it is of significant value if a method can be found that allows 'real messages' to be transmitted by embedding it in non-sensitive information after (or otherwise) it has been encrypted. This is known as Steganography which is concerned with developing methods of writing hidden messages in such a way that no one, apart from the intended recipient, knows of the existence of the message in contrast to cryptography in which the existence of the message itself is not disguised but the content scrambled.

Steganography provides a significant advantage over cryptography alone in that messages do not attract attention to themselves. No matter how well plain text is encrypted, by default, a ciphertext will arouse suspicion and may in itself be incriminating, as in some countries encryption is illegal.

To emphasise this issue, suppose that it had been known by Germany that the Enigma ciphers were being compromised by the British during the Second World War through the de-coding technology developed by the Polish Cipher Office in the 1930s. It would then have been strategically advantageous for Germany to propagate disinformation using Enigma. If, in addition, 'real information' had been encrypted differently and the ciphertexts embedded somehow in the signals of the German home radio service, for example, then the outcome of the war could have been very different.

Stegocrypt

Stegocrypt is a new method of hiding encrypted information in digital signals and images developed by SFI Stokes Professor Jonathan Blackledge. It is based on work that forms part of his latest book entitled 'Cryptology, Fractals and Chaos' (published by Horwood Scientific Publishing Limited, 2009, ISBN: 9781904275220). The aim of this book is 'to show how chaos theory can be used to design high-strength ciphers and how fractals can be used to hide the existence of the ciphertexts they produce' says Professor Blackledge.

The current system allows a user to input an e-document and a host image into which the document is to be hidden. The document is then encrypted using chaos and embedded into the host image using a PIN. However, the real value of the system is the facility it provides for e-Fraud prevention in which the e-document and host image are one and the same. This allows the recipient of an email attachment containing an accompanying document — typically a pdf file — to authenticate it.

"By the next academic year, I want to have the infrastructure in place to use Stegocrypt on all e-certificates issued by DIT to its students says Professor Blackledge".

There are numerous applications of this technology but using it to prevent e-Fraud of e-certificates issued by institutes such as the City and Guilds London Institute and universities in general would seem a good place to start. An online facility will allow users to detect any tampering of a certificate — a change of name and/or qualification, for example. Any employer who wants to check up on the authenticity of an e-certificate issued by, for example, DIT will be able to do so quickly and efficiently prior to selection and/or interview.

Other applications

- Letter verification in which a user can authenticate the text of a letter.
- Signature verification. The authentication of digital signatures and other biometric data that may accompany a document including photo ID.
- Secure and covert information interchange.
- Plausible deniability by using conventional encryption methods to encrypt a stegocrypted file.

Advantages

- Self-authentication. Creates an encrypted watermark that is derived from the document itself without reference to a separate host image.
- Tamper Proofing. The watermark cannot be removed without changing the properties of the data so that tampering and e-Fraud can be detected easily.
- Covert Encryption. The method allows information to be covertly encrypted into a document designed to provide disinformation.
- Encryption Independent. In principle, any encryption system can be used to secure the data so that an existing key-management infrastructure can be utilised as required including PKI.

Technology Description

Attaching images of documents (typically pdf files) in email communications is an increasingly common practice. However, when the documents are of a type such that authentication of the information they contain is mandatory or at least desirable, it is necessary to provide an additional source of information for this purpose such as a digital seal.

Stegocrypt allows a user to encrypt the output of any image or image based document irrespective of the information it contains (ie written material, company logos, signatures, photos etc.) or document type — word document or excel spread sheet, for example. The image information is encrypted using a unique algorithm based on a set of different chaos generating Iterated Function Systems. The encrypted information is then embedded in the original document image using another encryption algorithm. Upon reception the document can be authenticated by extracting the encrypted watermark and decrypting the information it contains. Textures can be used to enhance the method further by masking or camouflaging the existence of a watermark thereby preventing an attacker from being able to tell whether a watermark is present or otherwise. Stegocrypt is the first system of its type to combine both encryption and steganographic algorithms in an attempt to solve a growing problem, namely, e-Fraud.

Irish Security Research Network

DIT is one of a number of Irish academic institutions and commercial organizations that are pioneering homeland security technologies coordinated by Enterprise Ireland's Director of the Irish Security Research Network, Dr Mike Murphy.

"The aim is to make Ireland a major player in security technology R&D as part of the development of a vibrant knowledge-based economy" says Professor Blackledge. "The Centre for Irish and European Security, launched earlier in the year, provides a Civil security policy and strategy in Ireland and Europe, in both a societal and an industrial context".

Commercialisation

Applications of Stegocrypt are not limited to e-certificates but to any e-document that requires protection from e-Fraud. It can be used routinely to authenticate letters written in MS-Word, for example, and in principle, any e-document that is sent over the internet as a pdf attachment. Professor Blackledge demonstrated the system at the International Academy, Research and Industry Associations First International Conference on Technical and Legal Aspects of the e-Society, DigitalWorld 2010.

Hothouse, DIT's Innovation and Technology Transfer Office, is currently looking for companies to licence the new system and continue research in the area of information security.

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[New Materials & Technologies]

RESEARCHING LIFE **ON MARS**

Two more DIT students have been given the opportunity to attend the annual space studies summer programme in NASA. We invited them to tell us about their impressions of life in a space research centre.

Paul Duffy is a postgraduate researcher in the School of Manufacturing and Design Engineering in DIT Bolton St. He is being supervised by Dr Gerry Woods, Dr James Walsh and Dr Sean O'Hogain and is developing a water quality monitoring and control system incorporating an automated e coli sensor. His research may lead to a range of applications such as monitoring drinking water and industrial process control.

Patrick Crowley qualified as an electrician before he started electrical services engineering in DIT Kevin Street. He was awarded his Bachelor of Technology Degree in May 2009. Patrick pursued research on "A study of photosynthesis under artificial lighting" for his final year project. Recently he won a gold medal in Ireland for a presentation on his research in the Young Lighter of the Year Competition held by the Chartered Institute of Building Services Engineering and the Society of Light and Lighting. Patrick then represented Ireland and DIT at the competition final in London in March where he received an international award. In addition, he presented his work at other International lighting competitions and also the Institute of Lighting Engineers' 40th Anniversary conference.

Paul and Patrick spent 9 weeks attending the Space Studies Program (SSP) run by the International Space University, held last summer in NASA Ames Research Centre, California. In order to attend the course they received sponsorship from DIT, Enterprise Ireland, the European Space Agency and the Gogarty Scholarship. The course consisted of four weeks of core lectures covering a wide range of topics from rocket propulsion to international cooperation. At the end of the core lecture series students sat a four hour exam based on the lectures. Following this the course was split into different departments for two weeks of intensive activities.

The departments were Life Sciences, Physical Sciences, Space Systems Engineering, Satellite Applications, Business and Management, Law and Policy and Space and Society. Activities included workshops, site visits, lectures by industry professionals and experiments. Students were assessed at the end of the department activities by presenting a review paper or the results of an individual/small group project. The final three weeks of the course were allotted to team projects. Students were able to choose from one of three projects: ACCESS Mars — studying the use of lava tubes on Mars as a habitation solution; DREAM — developing disaster relief management using satellite technology for the World Bank; and SAFEN — Earth reviewing space based renewable energy solutions. The team projects culminated in presentations to many industry professionals and officials from space agencies around the world and the publication of a 100 page report.

Paul

I really had a great summer. Aerospace is something which has interested me for a long time. However, being based in Ireland limits the exposure one can get to the industry. I heard of the course through Mark Wylie, another postgraduate in DIT, who attended the previous year's SSP in Barcelona. Being based at NASA was very interesting. Ames Research Centre is the lead centre for the LCROSS mission. They are also developing miniature lunar landers. And it's home to the world's biggest wind tunnel where they tested the space shuttle. The centre is based in the heart of Silicon Valley so there are a lot of huge companies right next door like Google and Yahoo.

Patrick

I can easily say that summer at NASA Ames was an experience of a life time. The Space Studies Program offered quite a broad and interesting core curriculum covering all disciplines related to space including: space science, space engineering, systems engineering, space policy and law, business and management, and space and society. The class was made up of 140 people representing 36 different countries. The participants

came from different professional backgrounds, including engineers, lawyers, artists, space technology engineers, biologists and even the first Korean woman to go to space. I learned a lot of new skills from them and made a lot of new friends.

Paul

I found the core lectures very interesting. Most of the material was new to me and I felt I got a good grounding in most areas of the industry. For my department project I teamed up with two other guys and we conducted an experiment called 'The Effects of Gender Distribution on Group Dynamics'. It involved getting groups with different gender make ups and putting them through a series of tests. It didn't really work out that well but it was the first time that any of my team had tried to run a psychological experiment before. It's not something I ever thought I'd end up doing but it was good fun and at least I learned how not to run a psychological experiment!

Patrick

The core lectures were very intense but equally interesting. For the department project I presented my further research on 'The Role of Artificial Lighting for Photosynthesis in Space'. I had previous research done and my new findings were suitable applications for this technology on primarily longer space missions to places like Mars. I received very positive feedback as they would like to use my presentation for teaching in the core lectures next year.

Paul: I did a parabolic flight which was really good fun. During the flight we simulated lunar, martian and zero gravity. It's definitely something I recommend everybody to try.

Patrick

There was a choice of entry into different departments to suit the various backgrounds. I chose the life science department as it looked particularly interesting and was related to my previous research. We attended presentations in Stanford University on robotic surgery and had the opportunity to perform surgery on dummies using the latest robotic technology. In addition, activities in our department involved dissecting hearts, lungs and practising our suturing skills on a pig's leg.

We also diagnosed illnesses using role play and conducted extra vehicular activity (EVA)/neutral buoyancy training of a satellite repair mission. We had a video conference with NASA staff in Devon Island who were testing manned rovers and space suits. The final three weeks were dedicated to our team project which was designing a habitat for an initial human settlement in caves on Mars. I was one of 54 members of the ACCESS Mars team. I was part of the life support systems and engineering group. I was responsible for the lighting design and greenhouse design which would provide food and oxygen for the habitants. In addition, future concepts (eg simulating daylight within the cave), suggestions for the project, referencing and editing were part of my contribution.

Paul

I was also part of the ACCESS Mars project. I studied the psychological issues involved with subsurface habitation and general medical problems associated with Martian exploration. I was also part of the report editing team along with three others. It involved a lot of late nights. The hardest part was trying to fit the work of 50 people into 100 pages, but I think we did a pretty good job of it. The report and final presentation received a lot of positive feedback. With regard to my future plans I hope to move into the aerospace industry after I finish my current research and the contacts I made during the SSP will be very useful when I do. Currently we are establishing a space research group within DIT to help both undergraduates and postgraduates become involved in aerospace.

Patrick

I intend to utilise the amazing experience I gained from the staff and my classmates at NASA Ames to carry on learning, working and meeting people in a positive manner. I have started a new job as a graduate engineer and furthering my studies will be an ongoing priority.

[Information & Communication Technologies]

NEW SEARCH ENGINE FOR TRADITIONAL IRISH DANCE TUNES

Have you ever heard a traditional Irish tune but just can't place the name…? Well one of DIT's lecturers has developed the technology behind a new website that will help you do just that.

There are at least seven thousand traditional Irish dance tunes in the canon and musicians playing traditional music have a personal repertoire of up to 1,000. Given this diversity musicians and ethnomusicologists can find it difficult to identify tunes from playing. It is a common problem at traditional music sessions and is evident even on commercial recordings which often list track titles as gan ainm (without name).

To solve this problem, Dr Bryan Duggan, a lecturer in the DIT School of Computing has launched a unique query-by-playing search engine for traditional Irish dance tunes. tunepal.org is based on Bryan's recently completed PhD thesis on "Machine Annotation of Traditional Irish Dance Tunes". His work was jointly supervised by Professor Brendan O'Shea of the School of Computing and Dr Mikel Gainza of the Audio Research Group. tunepal.org is a web site that allows a musician to play a few notes from a tune on a traditional instrument and find a match in a database of over twelve thousand tunes drawn from popular collections including O'Neills Dance Music of Ireland.

The system supports queries played on the most popular traditional instruments including the flute, tin-whistle, uilleann pipes, fiddle, concertina and accordion. The transcription and matching algorithms in tunepal.org try to model the types of musical intelligence possessed by a musically literate human listener.

The system is transposition invariant and compensates for various types of expressiveness that a musician might employ including ornamentation and tempo deviation. In experiments using one hundred real-world field recordings of traditional music (from sessions, classes, concerts and commercial recordings), Bryan's work has a 93% accuracy rate for identifying the correct tune as the closest match. This compares very favourably with related systems and is a unique attempt to adapt Music Information Retrieval (MIR) to the specific characteristics of traditional Irish dance music.

Since launching in August 2009, tunepal.org has been used by almost five hundred users from around the world to search for over three thousand tunes. Bryan's work has been featured in Artscape in the Irish Times (1 August, 2009) and he recently won the best presentation prize at the prestigious International Computer Music Conference in Montreal, Canada for a paper based on his work. Delegates at the conference voted his paper "Compensating for Expressiveness in Queries to a Content Based Music Information Retrieval System" best of the 100 papers delivered. He is currently working on an iPhone application which can be used to identify tunes in situ in traditional music sessions.

For more information contact: **bryan.duggan@dit.ie** **www.comp.dit.ie/bduggan** and **www.tunepal.org**

[New Materials & Technologies]

WOBBLY BRIDGE **STIMULATES NEW RESEARCH PROJECT**

The London Millenium footbridge which opened in 2000 was nicknamed the 'Wobbly Bridge' after participants in a special opening event felt an unexpected swaying motion — known as lateral synchronous excitation — as they walked across it. The bridge was closed for two years while modifications were made and it was re-opened in 2002. Now DIT researchers are investigating the phenomenon with research colleagues from UCD and AIT and an industry partner (O'Connor Sutton Cronin Consulting Engineers).

Lateral synchronous excitation occurs when pedestrians on a bridge begin to move in sync with the dynamic oscillations of the bridge which accentuates the problem. The event in London stimulated a lot of research to help formulate design rules for pedestrian bridges but these are now known to be conservative. The research team led by Dr Colin Caprani of DIT Bolton St, Department of Civil and Structural Engineering, hopes to address this using a combination of statistical analysis, dynamic modelling and field testing.

Funded by DIT's ABBEST scholarship scheme, Colin and his team (Dr Paul Fanning (University College Dublin), Dr Paul Archbold (Athlone Institute of Technology) and Paul Healy (O'Connor Sutton Cronin Consulting Engineers)) hope to identify a more rational basis for the design rules based on known statistical parameters of the problem.

The industry partner will advise on the practical design aspects, in addition to assisting with field testing. A postgraduate student has also been recruited to the project and the project manager will consider applications from exceptional fee-paying graduates of civil or structural engineering.

For more information contact **e: colin.caprani@dit.ie**

[Social, Business & Economic Development]

LECTURER BECOMES **PRESIDENT OF EUROPEAN BUSINESS COUNCIL**

Dr Thomas Cooney of the Dublin Institute of Technology has become the first Irish person to achieve the position of President of the European Council for Small Business (ECSB).

ECSB is a non-profit organization whose main objective is to advance the understanding of entrepreneurship and to improve the competitiveness of SMEs in Europe. The organisation has over 400 members in 33 countries and it facilitates the creation and distribution of new knowledge through research and education across national and cultural borders. Dr Cooney has identified increased benefits to members and greater relevancy of ECSB's work to the business community as the priorities for his two-year term of office.

Dr Cooney is a Research Fellow at the Dublin Institute of Technology and Director of the Institute for Minority Entrepreneurship (DIT). In addition to being President of the European Council for Small Business (2009-2011), he is also Adjunct Professor at the Turku School of Economics (Finland), a member of two European Commission Expert Groups, a Council Member of the Irish Research Council for Science, Engineering and Technology (IRCSET) and was the founding Chairman of Ireland's Network of Teachers and Researchers of Entrepreneurship (INTRE). He is a former Visiting Research Scholar at Babson College (USA) and University of Durham (UK). He has researched, presented, and published widely on the topic of entrepreneurship, including the books 'New Venture Creation in Ireland' (with Shane Hill), 'Irish Cases in Entrepreneurship' and 'European Cases in Entrepreneurship' (with Rickie Moore). More recently Dr Cooney has helped develop a set of proposals for the adoption of a coherent entrepreneurship education strategy that would see entrepreneurship being taught in primary, secondary and third-level schools.

Dr Cooney also co-authored a major report on ethnic entrepreneurship in Ireland. From a nationwide survey of 1,108 foreign nationals resident in Ireland it was determined that 12.6% claim ownership or part ownership of a business, a rate that is significantly higher than identified amongst the native Irish community. A profile of the ethnic businesses found that they are generally small in scale (64% have an annual turnover of less than €50,000), young in age, concentrated in the locally traded services sectors and operating at the margins of the mainstream economic environment. The report found that ethnic entrepreneurship in Ireland in its scale and industry focus is comparable to international experience of ethnic entrepreneurship.

Further information is available from his website:
www.thomascooney.com and from **www.ecsb.org**

DIT WINS MAJOR EU RESEARCH AWARD FOR **ENTREPRENEURSHIP CASES**

Dr Thomas Cooney recently led a team of European researchers that successfully won a contract to develop the writing of entrepreneurship case studies across Europe. The total budget for the project is €562,000 and the EU has agreed to contribute €280,000 to this work.

The use of European case studies in entrepreneurship has been highlighted as being critically important as they enable students to identify with local role models and with local challenges. The publication 'Entrepreneurship Survey of Higher Education in Europe' in October 2008 stated that 'Entrepreneurship is, to a large extent, a "learning by doing" subject, meaning that the practical aspect of learning from what others have done before is crucial.

Entrepreneurial teaching is often based on cases. Many of the in-depth interview respondents pointed out the importance of recognition and identification with the cases as well as the need for development of national and local case studies that can be used in entrepreneurial education.

The publication 'Entrepreneurship in Higher Education, Especially Within Non-Business Studies' in March 2008 also highlighted that the use of case studies was seen as one of the most effective methods of teaching entrepreneurship education to young students. However, it is broadly accepted that there remains a significant shortage of European cases in entrepreneurship.

The primary objective of this project is to create a practical, student-centred pedagogical tool for entrepreneurship educators throughout Europe. This will be achieved through the development of a comprehensive, contemporary range of European case studies on entrepreneurship.

The objectives of this project are as follows:

- Create a library of 30 European entrepreneurship cases studies to be made freely available in 6 of the main European languages.
- Compile an additional 20 existing cases studies written during previous EU projects (English language only).
- Make 50 entrepreneurship case studies (30 multi-lingual and 20 English) freely available to both students and educators in third level institutions through the use of a dedicated website; www.europeanentrepreneurshipcases.eu.
- Raise awareness of case studies as a pedagogical tool for entrepreneurship educators throughout Europe by distributing a free Entrepreneurship Case Study book (2,500 copies).
- Deliver a series of workshops and webinars across Europe entitled 'How to Write Case Studies for Teaching Purposes' which will help increase local production on a sustainable basis.
- Promote entrepreneurship among third level graduates by instigating a European Student Entrepreneurship Competition.

Third level educators in the field of entrepreneurship and third level students across all academic disciplines are the two target groups in this project. Making contemporary, European-relevant entrepreneurship case study material freely available for pedagogical purposes is the primary objective of this project. Existing constraints – availability and accessibility of appropriate case study material, English language-only case study material and/or American derived case study material – militate against the widespread and effective use of case studies as a pedagogical tool for entrepreneurship. This proposal will help to meet the needs of entrepreneurship educators and students by addressing the constraints to case study usage experienced by both groups at present.

[Food & Health Sciences]

THE FUTURE IS SOUND

The Medical Ultrasound Physics and Technology Group based in the School of Physics and the FOCAS Research Institute is currently developing a range of anatomically realistic renal and breast test phantoms for evaluating current and emerging medical ultrasound technology. Their research could lead to significant cost savings in the health sector and early diagnosis of serious illness.

The group is led by Dr Jacinta Browne, a lecturer in the School of Physics in the Faculty of Science. This work is funded under the Department of Education and Science's Technological Sector Research Strand I funding scheme (2005, 2006, 2007) and the Dublin Institute of Technology's TERs 2005 funding scheme. The research is divided into two main projects — the development of anatomically realistic renal flow and perfusion phantoms and the development of anatomically realistic breast phantoms and contrast phantoms for high frequency applications.

The research aims to provide evidence of how individuals at risk of renal artery disease can be identified at a much earlier stage and with more accuracy, improving their long-term prognosis and quality of life. Early identification could also lead to substantial cost savings in the Irish healthcare system. For example, the cost of a year's dialysis for one patient is approximately €50,000. Early diagnosis could prevent the need for this course of treatment.

The aim of the first project was to develop a range of phantoms with varying degrees of blockages thus replicating the clinical condition renal artery stenosis (RAS). This project was successfully completed in June 2009, by Deirdre King, who was awarded her PhD in October. The project was carried out in collaboration with Robert Simpson a lecturer in the School of Manufacturing and Design Engineering and Dr Carmel Moran of the Medical Physics and Medical Engineering Unit and the Centre for Cardiovascular Science in the University of Edinburgh, who jointly supervised Deirdre King's PhD project with Dr Browne.

Renal artery stenosis is a blockage of the major artery that supplies blood to the kidney. It is considered the most common cause of potentially curable renovascular hypertension (RVH) — a form of secondary hypertension. If left untreated this progressive disease has many associated morbidities including progressive renal insufficiency, myocardial infarction, congestive heart failure, stroke and death. RAS was therefore an important clinical disease to replicate and study.

The validation of new imaging techniques often includes phantom (in-vitro) experimentation because clinical trial alternatives are often expensive and lengthy, have a small number of participants and associated ethical issues. Very little research had been carried out to determine the imaging capabilities of current ultrasound technology and exciting new and emerging technologies such as ultrasound contrast agents for the detection of RAS. Furthermore, the flow phantoms used to date in the validation of new imaging technologies tend to be simplistic and do not represent the complex geometry of the vessel of interest, the renal artery in this case.

The aim of the first project was to develop a range of phantoms with varying degrees of blockages thus replicating the clinical condition renal artery stenosis (RAS).

Developments in computer-aided design and rapid prototyping have allowed the Medical Ultrasound and Physics Technology group to obtain three dimensional (3D) anatomical reconstruction of the renal artery using data from clinical computed tomography data sets. A range of anatomically realistic renal artery flow phantoms was developed and this range of phantoms consisted of normal healthy vessels and vessels with varying degrees of stenosis (30%, 50%, 70% and 85%, respectively).

The major benefit of these anatomically realistic phantoms is that new ultrasonic techniques can be validated in an objective and safe manner without the need for clinical trials. Furthermore, it is possible to obtain velocity profiles and wall shear stresses comparable to those measured in the renal artery which allows us to gain a better understanding of the disease progression. The researchers hope their work will provide evidence of how vulnerable individuals could be identified more accurately and at a much earlier stage so that their long-term prognosis and quality of life will be improved.

For more information contact **e: jacinta.browne@dit.ie**

[Food & Health Sciences]

POSTGRADUATE EXPERIENCE LEADS TO **PRESTIGIOUS POST**

Dr Deirdre King who conducted her research in DIT's Medical Ultrasound Physics and Technology group and was recently awarded her PhD in physics has been offered a place on a prestigious two-year postdoc programme. The Medical Physics Residency program in Clinical Diagnostic Medical Physics is based in the highly renowned Mayo Clinic in Rochester, Minnesota.

Dr King's PhD project was titled "Development of Renal Phantoms for the Evaluation of Current and Emerging Ultrasound Technology". For her research she evaluated current non-invasive ultrasound techniques capable of diagnosing all grades of blockages in the renal artery. She was supervised by Dr Jacinta Browne a lecturer in the School of Physics and Medical Ultrasound Physics Technology Group leader.

The primary aim of this project was to evaluate current non-invasive ultrasound techniques, capable of diagnosing all grades of blockages in the main artery supplying blood to the kidney. The novel aspects of this study were the development of anatomically realistic renal flow phantoms and the development of kidney perfusion phantoms for use with ultrasound contrast agents.

These phantoms have the potential to provide a better understanding of disease progression by studying the haemodynamic features within them, thereby improving the detection of this disease and allowing less invasive treatment to be delivered to the patient.

This work was carried out in collaboration with Dr. Carmel Moran from the Medical Physics Unit at the University of Edinburgh, who was a co-supervisor of Dr King while she carried out her PhD research project.

With a PhD in Medical Ultrasound Dr King was ideally suited to the Medical Physics Residency program which will specialize in Ultrasound and Magnetic Resonance Imaging. Training will also be provided to Dr King in other Medical Imaging techniques such as X-ray, Fluoroscopy, Angiography, Mammography, CT, Nuclear Medicine, Positron Emission Tomography and Radiology Informatics.

The Radiology Department at Mayo Clinic in Rochester is fully integrated with all the medical services available at the Mayo Clinic. More than 140 radiologists and 15 medical physicists along with over 1,000 support staff provide the highest quality diagnostic and interventional imaging services to patients, in a caring and efficient manner. Dr King will also have the opportunity to do a three-month rotation in one of the other Mayo Clinics in either Jacksonville, Florida or Scottsdale, Arizona.

The members of the Medical Ultrasound Physics and Technology Group, the staff of the School of Physics and the researchers in the FOCAS Research Institute are delighted that one of their graduates has been admitted to the programme and would like to wish Dr King the very best of success in her new post.

[Food & Health Services]

LINKS WITH CANADA BENEFIT PROSTHESIS RESEARCH

Colm O'Kane is a lecturer in the School of Manufacturing and Design Engineering and a member of the DIT Biomedical Device and Assistive Technology Research Group. He is currently engaged in PhD research in the field of knee prosthesis development, focused on developing optimised strategies for partial and total joint replacements used in treatment of osteoarthritis of the knee joint.

This summer, Colm travelled to Vancouver, Canada on a research scholarship sponsored by the CHC Helicopter Corporation and awarded by the Ireland Canada University Foundation (ICUF). This foundation awards annual scholarships for research visits between Ireland and Canada with the aspiration of fostering links between the two countries' research communities.

Colm's PhD work is based in the Bioengineering research group in University College Dublin, headed by Dr David FitzPatrick, Head of the School of Electrical, Electronic and Mechanical Engineering in UCD. His research area is the geometric morphology of the knee joint, examined through analysis of medical images. He aims to use computer models to develop more sophisticated sizing and shaping rationales for knee replacement components, which more closely conform to the variation in the population's joints than present approaches. This work is based primarily on computational modelling so the prospect of a research linkup with UBC, who have expertise in the complementary field of practical testing of cadaveric samples, was very attractive. While in Vancouver, Colm worked with the University of British Columbia's Orthopaedic Engineering Research group, which is headed up by Dr David Wilson. The visit began with Colm giving a talk for the UBC group on research work currently being undertaken in this area in both UCD and DIT.

I presented an overview of our research group's work to the Canadian researchers, and the subsequent discussion uncovered possible areas for future collaboration. I also undertook training for working in the university's anatomy laboratory and in the MRI facility.

He worked closely with Emily McWalter, a PhD student supervised by Dr Wilson, whose field of study is the examination of risk factors for the development of osteoarthritis, through determination of the contact area of the joint. She has previously worked on the development of an MRI based method for the investigation of contact areas and pressures at the patellofemoral joint. The project Colm and Emily worked on together was the validation of this method through cadaveric experiments.

A succession of human specimens were dissected and mounted in an MRI-safe rig. The joint was subjected to external loading and then dye was injected into the joint space. Upon opening the joint capsule, areas not penetrated by the dye showed contact between patellar and femoral cartilage. The patellar surface was scanned using a laser scanner to give a measure of the 3D area. A pressure measurement system was also used to give a quantitative measure of joint pressures.

Finally, the knee was MRI scanned under the same loading conditions in order to establish agreement between the dye-based and image-based contact areas. Research work was divided between the anatomy laboratory (for dissection of the specimens), the biomechanics laboratory (for dye-based contact analysis), and the 3-Tesla MRI suite at Vancouver General Hospital (for MRI scanning of loaded specimens). The variety of the work ensured Colm got experience in a number of areas.

I gained invaluable experience in preparation and testing of specimens and I also worked on analysis and manipulation of the MRI and laser scanned data in order to give accurate and repeatable measurements for surface contact area.

Provisional results from the work show excellent correlation between the measurement methods and it is hoped that the MRI-based contact analysis method can be rolled out for patients, giving surgeons another tool for early identification of indicators for knee joint arthritis and other issues. Back in DIT, Colm plans to develop his research into the relationship between knee component shape and function and the prospect of developing statistical models to enable more effective diagnosis of joint-related conditions. He will also consult with surgeons in Dublin's Mater Hospital to compare knee replacement procedures here to the Canadian approach. He sees the UBC visit as a key step in the process of identifying the core research questions for his work.

I am very grateful to the board and sponsors of the ICUF for giving me the opportunity to undertake this research visit and to the UBC research group for hosting the visit. Through this work I have gained experience which will be invaluable to my PhD work and also made valuable contacts with academics in Canada which will hopefully form the basis for fruitful collaboration in years to come. The expertise gained in this visit has been instrumental in the development of my research.

For more information contact **e: colm.okane@dit.ie**

DIT ENGINEERING STUDENTS WIN **EUROPEAN SPACE AGENCY'S REXUS COMPETITION**

A group of engineering students from the Dublin Institute of Technology have become the first ever Irish team to be selected to fly an experiment on a sub-orbital space flight by the European Space Agency. The team of five postgraduate engineers was selected after winning REXUS, the Europe-wide competition run by the European Space Agency. The team consists of students: Mark Wylie, Paul Duffy, Dinesh Vather, Stephen Curran and Jack Keegan. A number of undergraduate engineering students from DIT are also participating in the experiment. The group itself is being advised by Dr Marek Rebow, Head of Engineering Research in DIT.

As winners of this prestigious competition, not only will the team be the first Irish team to be selected, but now, they will have the opportunity to fly their experiment on a sounding rocket from the Esrange Space Centre in Kiruna, Sweden, in March 2011. The launched experiment will examine the feasibility of a prototype telescopic boom. If the experiment is successful, the probe designed by the DIT team would significantly reduce the space required by current probe design, thereby increasing the number of probes that may be used on any one rocket.

The team's launch and experiment is being funded by the European Space Agency and DIT, while Enterprise Ireland and Irish aerospace companies are contributing to the project in the form of both help and equipment. The team is due to travel to the Arctic Circle-based Esrange Space Centre next month for a training week and preliminary experiment design review. The team will also be undertaking an outreach programme. Through this programme they will be discussing the project with second and third-level students through a series of lectures and seminars. You can follow the team's progress over the coming months and find further information on the REXUX programme on:

Facebook — Rexus Dit
Wordpress.com — REXUS DIT
www.youtube.com/watch?v=8HNfPuAs1UM

[New Materials and Technology]

ENGINEERING APPLICATIONS OF FIBRE OPTIC SENSORS

DIT's Photonics Research Centre (PRC) has recently been awarded a significant amount of funding to investigate several engineering applications of fibre optic sensors.

One strand of this research is funded under Enterprise Ireland's Proof of Concept scheme. This is focused on investigating a disposable fibre optic temperature sensor for monitoring temperature in thermosetting resins, curing concrete and healthcare applications where the sensor is exposed to a wide range of temperatures and must be sacrificed at the end of the measurement cycle. This novel low-cost fibre optic sensor developed by the researchers in PRC offers a wide temperature range (up to 250 ^{0}C) and a competitive temperature resolution (0.5 ^{0}C or better).

Another research strand is funded under the FP6 ERAnet MATERA programme, administered by Enterprise Ireland. This project is investigating a novel approach to health monitoring and structural control of advanced high value composite parts such as helicopter rotor blades, aircraft fuselages, wing structures and other high-performance applications. To ensure the integrity of composite parts, it is desirable to simultaneously monitor strain, temperature and vibrations experienced by these parts in real time. The approach proposed by the PRC is based on a hybrid sensor system composed of a fibre Bragg grating (FBG) and a highly birefringent (HB) fibre polarimetric sensor embedded at the manufacturing stage for sensing of multiple parameters over the lifetime of the composite part. This research is being carried out in collaboration with researchers in Warsaw University of Technology and Polish helicopter manufacturer PZL Swidnik S. A., Poland.

Funded under the DIT's Capacity Building Scheme (CaBS), researchers in the PRC are also working on two engineering applications of optical sensing. The first is the application of fibre optic sensors for biomedical devices involving strain sensing for robotic surgical instruments. To achieve improved force feedback the surgical instruments that are an integral part of the robotic end effector need to be sensorized. In collaboration with the School of Manufacturing and Design Engineering the project is investigating an optimal FBG interrogation technique to extract the low strain values expected and is also exploring the possibilities for embedding the sensors within the surgical instrument. The second engineering application is optical sound field measurement for traffic noise measurement, being undertaken in collaboration with the National Institute of Transport and Logistics (NITL) at DIT.

Other research strands at the PRC includes modelling of fiber waveguides and planar lightwave circuits, novel fiber sensors for physical, chemical and biological applications, fiber optic systems for sensing applications and liquid crystal tunable filters. The Centre is led by its Principal Investigators, Professor Gerald Farrell and Dr Yuliya Semenova, supported by senior researchers, post-doctoral researchers and several doctoral graduate students.

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[Commercialisation]

RESEARCHERS SCOOP TWO OUT OF THE THREE **TOP AWARDS**

Enterprise Ireland recently hosted the first BIG IDEAS Showcase. The event was organised by Enterprise Ireland's Research & Innovation Business Unit and showcased the commercial opportunities emerging from Ireland's Higher Education Institutes in the areas of:

Life Science & Food
ICT
Industrial Technologies

The Big Ideas Showcase is part of the Government's strategy to commercialise publicly funded research, which has produced over 100 new companies to date, the majority of which were created in the last 3 — 5 years. There were 150 one-to-one meetings between Irish inventors and investors to explore the options to either licence these new technologies or use them as the basis to form new companies in the energy, life sciences, medical, engineering and IT sectors.

Among the new inventions were: a no-needle vaccination patch; holograms that thieves cannot counterfeit; bacteria that eat plastic and turn it into eco-friendly fat; an indoor GPS system; paint that kills MRSA on contact; melt-in-the-mouth tablets; and IT solutions that will mean you can instantly access the internet in WiFi hotspots and in awkward areas where there is currently no line-of-sight broadband access.

Three Enterprise Ireland Commercialisation Awards were presented at the Showcase recognising the achievements of those researchers who have successfully commercialised their research and DIT researchers won two of them.

The first of the winners was Dr John Colreavy from DIT's Centre for Research in Engineering Surface Technology (CREST). Dr Colreavy and his team have developed an antimicrobial coating that effectively kills MRSA and e coli bacteria.

The technology was licensed to General Paints, Celbridge, Co Kildare, who used it in a new antimicrobial paint — HyGen. General Paints with their partner Tegral secured their first sale of this product to Beaumont hospital. Given the high incidence of hospital acquired infection globally, the company is confident that their project has good export potential. To this end, they are working actively with the Enterprise Ireland overseas network to secure export sales early in the New Year. As a result of this deal, General Paints hopes to create 10 extra jobs with forecast sales of €4 million within 4 years.

The second winner was Dan Barry, Senior Researcher with DIT's Audio Research Group. He has invented a range of unique audio signal processing technologies that have captured the interest and acclaim of a variety of companies and analysts around the world and here in Ireland. His technologies allow people to sing karaoke style alongside the original sound tracks of their favourite bands. This was licensed into the popular Sony Playstation 3 Sing Star Karaoke game.

His technologies also allow you to practice playing any instrument alongside your favourite musician and then substitute for that musician and play with the rest the band. He has also taken the snap, crackle and pop out of 45's and 75's and even drum recordings from the Irish Traditional Music Archives. His technologies can slow down or speed up any singer without changing the pitch and of course he can also change the pitch so you can see, for example what a female equivalent to a male singer might have been.

Dan won the award for licensing many of these technologies to Trezur Ltd, an Enterprise Ireland client that specialises in music software and services. The addition of the range of technologies Dan developed greatly enhances Trezur's ability to serve its markets.

This is the culmination of several years of creating a culture of entrepreneurship and commercialisation in DIT,' says Tom Flanagan, responsible for Hothouse, DIT's Innovation and Technology Transfer Centre and Head of Commercialisation at DIT.

The awards were presented by Conor Lenihan TD, Minister for Science, Technology & Innovation who launched the Big Ideas Showcase — an event pitching 21 exciting new technologies to over 200 potential investors. Brendan Ring, Hothouse's Commercialisation Manager, pitched Active Holographics: an anti-counterfeit hologram that is easy to verify by blowing on it and difficult to copy. Dr John Colreavy also presented Radical a company offering an innovative solution to hospital acquired infections through catalytic coatings.

Minister Lenihan, commented, "This event demonstrates the spectrum of entrepreneurial activity in the Irish research system. At the early stages we have 21 new technologies that are generating high levels of interest from the potential investors here today, and at other end, we have three award winners who have already succeeded in getting their technologies onto the marketplace, creating 20 new jobs in the process. I look forward to the creation of more new companies and jobs as a result of today's Big Ideas Showcase".

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[New Materials & Technologies]

4G ANTENNA DESIGNS LICENSED TO **TAOGLAS LIMITED**

DIT's Antenna & High Frequency Research Centre (AHFRC) has signed a license agreement with Taoglas, a worldwide antenna solutions provider, for antenna design and research support in connection with ultra-wideband antenna technologies covering markets such as LTE and WiMax.

It comes at a good time as Taoglas continues to grow with offices in Taiwan, Mexico, the US and South Africa. Joint Managing Director Dermot O'Shea says "This license allows us to lead the way in emerging 4G antenna technologies by working with the brightest minds in the field. Taoglas has now the most complete advanced range of communication antenna technologies in the business. DIT AHFRC's team of researchers have achieved a break-through in high efficiency antenna designs that Taoglas has developed further to make into real commercial applications in areas such as telematics, smart metering, automotive and industrial solutions". Taoglas Ltd was established in 2003 and its head office is based in Ireland. It delivers competitive solutions keeping the cost of designs and components down through their winning global supply chain.

AHFRC

Dr Max Ammann is Director of the Antenna & High Frequency Research Centre, currently comprising 5 post-doctoral researchers and 7 graduate students. He lectures in DIT's School of Electronic & Communications Engineering and is currently leading several funded research programmes. He has published over 150 articles in journals and international conferences and leads antenna research within Ireland's Centre for Telecommunications Value-chain Research (CTVR). His research interests include electromagnetic theory; antenna miniaturization for terminal and ultra wideband applications; antennas for wireless networks; metamaterials; antennas for medical devices; and antenna integration with photovoltaic systems.

Dr Ammann sits on the management committee of the EU COST Action IC0603, "Antenna Systems & Sensors for Information Society Technologies" (ASSIST) and he is active in the Antenna Sensors and Systems Work Group. As a member of the IEEE International Committee for Electromagnetic Safety, he participated in the revision of the IEEE Standard C95.1, 2005 & 2009 for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

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Dublin Institute of Technology

SFI SUPPORTS DIT **ANTENNA RESEARCH**

A Dublin Institute of Technology engineering researcher is one of the fifteen inaugural recipients of Science Foundation Ireland's Starting Investigator Research Grant (SIRG).

Dr Xiulong Bao has been working with Dr Max Ammann on novel techniques to enhance the bandwidth of circularly polarised antennas. His solutions are paving the way for smaller integrated packaging of multiple radio devices. Preliminary results indicate that Dr Bao's novel methods will support the bandwidth necessary for improved wireless multimedia links.

Announcing the awards, Minister of State for Science Conor Lenihan recognised SFI's strategic role in developing new academic foundations for the Smart Economy. "These 15 outstanding individuals are among the brightest working in Irish laboratories today, and SIRG provides them with the necessary support to enable the transition from team member to independent and accomplished innovators in their respective fields. It will also allow them recruit 15 postgraduate students.

The group were selected from over 100 applicants from across the Universities and Technology Institutes. The awardees work in diverse areas such as renewable energy, cancer research, genetics and telecommunications. Professor Frank Gannon, the Director General of SFI, highlighted the relevance of each of the subject areas to solving real and imminent challenges facing society and the economy.

Congratulating him, Professor Ellen Hazelkorn, Director of Research & Enterprise at DIT, commented that "Dr Bao's research is building upon DIT's reputation for solving technological challenges through applied research.

His patents have become the basis of international industrial collaboration and are helping to sustain innovation in the Irish telecommunications sector."

Dr Bao joined the DIT's Antenna & High Frequency Research Centre (AHFRC) in 2005 from the Southwest Southeast University in China. His post-doctoral researcher post was supported by SFI's acclaimed Centre for Telecommunications Value-chain Research – a multi-institutional Irish research network on communications engineering. He will continue his research within the AHFRC with Dr Ammann as his mentor and he will employ a PhD student as part of the €484,450 research programme.

[Spotlight on Schools]

CHEMICAL AND PHARMACEUTICAL SCIENCES

The School of Chemical and Pharmaceutical Sciences is based in the newly established College of Sciences and is located in DIT Kevin Street. It can trace its origins to the first College of Technology established on the site in 1887 (although the current building dates from 1968) and courses in theoretical and practical chemistry were among the first delivered on-site. By 1896, the College offered courses in 5 discipline areas: science, art, technology, commerce and women's work and now included organic and inorganic chemistry reflecting developments within the field at that time.

Dr Declan McCormack is the Head of School responsible for the development of its teaching and research activities and is himself an active researcher as well as the Academic Director of DIT's Centre for Research in Engineering Surface Technology (CREST).

Academic staff have nurtured a growing research culture within the School and have attracted significant research funding and developed partnerships with world class researchers from Ireland and around the world. Their efforts ultimately contributed to the establishment of DIT's first research institute – the Focas Research Institute.

The Facility for Optical Characterisation and Spectroscopy which opened in 2004 was funded under PRTLI Cycle 1. United by the need for core spectroscopic facilities, researchers from a number of scientific disciplines backgrounds are housed within the Institute. It represents a truly interdisciplinary environment, exposing staff and students alike to a broad range of scientific enquiry.

Specialist laboratories – for example, Materials Synthesis and Applications (MSA), Biomedical and Environmental Sensing and the Radiation and Environmental Science Centre (RESC) provide accommodation for graduate students (MPhil and PhD) and full-time researchers and postdoctoral fellows. PRTLI Cycle 4 funding will be used to build more research space to accommodate its expanding research community.

A significant number of graduate students are also based in industry and organisations such as the Marine Institute and The State Laboratory. They also have an opportunity to spend time in other Universities such as TCD, UCD, DCU and NUI Maynooth. Other postgraduate students have travelled overseas — three have already spent a year in Rice University, Texas under the supervision of Professors Michael Wong and Kenton Whitmire.

Staff research interests

Academic staff have a broad range of research interests including nano-technology, environmental chemistry, food safety and biotechnology, organic and medicinal chemistry. The summaries below provide an overview of the range and depth of the School's research programme which is continuing to develop, with new projects, supervisors and areas emerging annually.

Dr Declan McCormack's interests include the investigation of nanoparticulate ZnO and TiO_2 and their electronic applications, sol-gel preparation of nanoparticulate materials and the environmental and toxicological impact of nanoparticles. He is a member of the IMPART (Improving understanding of the impact of nanoparticles in human health and the environment) European Co-ordination Action Programme.

Dr Michael Seery is interested in the photophysics of metal oxides and in particular the study of electron transfer in metal oxide systems. His projects are concerned with the development of novel visible light-activated metal oxide materials for photocatalysis applications and the study of the mechanism of enhancement of photocatalysis. His research group works closely with Dr Suresh Pillai (CREST) on the development of new coatings to make extremely durable surfaces with self-cleaning and antibacterial properties. He is also a member of the School's Chemical Education Research Team (CERT).

Dr Barry Foley and **Dr Patrice Behan** perform their research in collaboration with the Marine Institute and the State Laboratory. Their work focuses on marine food safety and environmental issues including the analysis of naturally occurring toxins in seafood such as shellfish. As one of twelve partners of the European BIOTOX project, the group is involved in the development, validation and standardisation of suitable analytical methods for the identification and quantification of lipophilic marine biotoxins. They are developing passive samplers as a tool for water quality monitoring and developing biological tests for the ecotoxicological assessment of marine sediments (in collaboration with the RESC).

Dr Mary McNamara works on the preparation and spectroscopic characterisation of metallo-derivatives of cyclodextrins with potential applications for the selective encapsulation and detection of chiral drugs. She works with a number of groups in the Focas Research Institute. With Dr Hugh Byrne and the POMM group (Physics of Molecular Materials) she has recently reported a systematic study of the effects of naphthalene and anthracene substitution on the properties of PPV-derivative conjugated polymers. These polymers exhibit a strong electroluminescence and have applications in OLEDs. She is also investigating the interactions of saccharides with carbon nanotubes to develop biocompatible composites and new analytical techniques to investigate the radiation-induced bystander factor in cell conditioned media.

Dr Claire McDonnell is working with **Professor Rory More O'Ferrall** (UCD) and is investigating the applications of biotechnology to oxidative biotransformations of aromatic substrates. The aims of this research programme are to examine the scope for processing fermentation products to form pharmacologically and industrially useful materials and to enhance the understanding of the mutagenicity of polycyclic aromatic hydrocarbons. In DIT she is developing a synthetic route using iron tricarbonyl complexes to convert arene cis-dihydrodiols formed by biotransformations to their trans-isomers, which are useful chiral building blocks. This development work is being informed by mechanistic and stability studies on the intermediate iron tricarbonyl complexes

Dr Christine O'Connor is interested in the design of targeted drug delivery vehicles and of suitable photosensitisers as chemotherapeutics. Work involving the synthesis and evaluation of novel cyclodextrin-folic acid conjugates as carrier molecules for PDT (Photodynamic Therapy) agents is in progress. FR-α is over-expressed in several human cancers including ovarian, breast and renal carcinomas and this property has been utilised to develop tumour-selective anti-neoplastic drugs. The photosensitisers and folic acid will both be covalently bound to the cyclodextrin. The rationale is that the cell-penetrating property of folic acid will be utilised to deliver the photosensitiser to the target tumour. In parallel, a series of metallic complexes of Ru(II) have been prepared and will shortly undergo evaluation in tumour and non-tumour cell lines for light and dark toxicity; due the their photochemical properties the complexes are suitable for photoactivation. Simple ruthenium complexes are unusually effective in suppressing the immune response by inhibiting T cell proliferation which warrants additional study of ruthenium complexes as anticancer drugs.

Dr Sarah Rawe and her group are interested in the design and synthesis of new DNA-targeting hybrid drugs and novel porphyrins for photodynamic therapy (PDT), both for the treatment of cancer. The research involves design of new chemical entities, synthesis and characterisation of these compounds and biological evaluation to determine affinity for DNA (for hybrids), dark and light toxicity (for PDT agents) and cytotoxicity. Collaborators include researchers from the University of Liverpool, TCD and Ruder Boškovic Institute (Croatia). In addition, the group are also developing new antimicrobial agents with potential applications in the food industry. This work began in the School of Food Science and Environmental Health and the group continues to work closely with this school.

Dr Anne Greene's research interests are in the area of validation and quality assurance in the pharmaceutical industry. Dr Greene and her student **Kevin O'Donnell** were awarded the prestigious Article of the Year award by the Institute of Validation Technology in the United States for a research paper they wrote on Quality Risk Management published in the Journal of Validation Technology in March 2007. The research was co-sponsored by the Dublin Institute of Technology and the Irish Medicines Board.

Dr Jack Treacy has been carrying out research in the field of atmospheric chemistry for over 20 years, developing considerable expertise in areas of stratospheric and tropospheric chemistry. He has performed an investigation of Dublin's air quality using an OPSIS long path UV system based on the principle of differential optical absorption spectroscopy (DOAS). He monitors pollutants including sulphur dioxide, nitrogen dioxide, ozone, benzene and toluene.

Dr Hassan Ali works with Dr Steve Jerrams and the Centre for Elastomer Research (CER) and his work involves the testing of biomaterials (soft tissue and soft tissue mimics). He is also an advisor on other projects including an investigation into the swelling phenomenon in elastomers subjected to fatigue.

Dr Ben Schazmann is investigating organic sensor molecules based on a calixarene platform. The fluorescent response to common anions and cations is being investigated. The incorporation of sensor chemistry into working devices is a desirable goal. In collaboration with Professor Dermot Diamond (DCU) an electrochemical sweat electrolyte sensor for the benefit of monitoring human physical performance and health is being developed.

Dr John Cassidy is investigating thin electroactive films as sensing layers using covalently attached porphyrin films for electrochemical catalysis and mediation — specifically for analysis in flowing streams. His research group uses reflectance spectroelectrochemistry for the study of processes at electrode surfaces with a view to developing gas sensors as well as studying the electrochemical destruction of trace organic molecules in wastewaters and the recovery of precious metals.

CREST (The Centre for Research in Engineering and Surface Technology) is a leader in surface coating and corrosion control and is housed in the Focas Research Institute. This DIT designated centre is a platform for applied research in surface science that contributes to academic and industrial growth on this island. It is the premier surface coating consultancy service in Ireland and a national approval laboratory that has been used by many Irish government agencies (eg An Post, Luas, NRA) to give advice on public and private projects. DIT has become the first institution to receive the highest rating of '1' under the Applied Research Enhancement Programme (AREP) for establishing CREST as a 'centre of excellence'.

CREST has assembled a team of highly trained scientists to focus on academic research and on helping companies in Ireland research and develop exciting new materials. There are 12 research programmes some of which are joint research projects with researchers from the School (Dr Sarah Rawe, Dr Michael Seery and Dr Declan McCormack). These include the development of a novel photoelectrochemical fuel cell and research into the applications of nanocrystalline photoactive materials such as TiO_2 and ZnO. CREST is a member of the EU consortium COST 540 — Phonasum.

The Chemistry Education Research Team (CERT) was established in 2005 with the aim of incorporating emerging ideas from education research into the day-to-day teaching in the School. Areas of interest include the development of project-based learning laboratories; the contextualisation of laboratory and lecture material; development of a virtual learning environment as a support platform for lecture delivery; the development of e-learning materials to facilitate online and distance learning and the development and implementation of community based learning group projects.

CERT researchers were recently awarded the Team Award as one of the prestigious National Awards for Excellence in Teaching by NAIRTL (National Academy for the Integration of Research and Teaching and Learning) for their work integrating and embedding research skills in undergraduate education. The award was presented by President McAleese at the National Awards ceremony in Dublin Castle in November.

[Food and Health Sciences]

DIT COLLABORATION TO IMPROVE EYECARE IN AFRICA

In 2005 the World Health Organisation announced that uncorrected refractive error (the need for a pair of glasses) was one of the leading forms of preventable blindness worldwide.

However, in countries such as Mozambique with a population of 21 million there are no trained optometrists and there is a critical need for trained eye care professionals. The Mozambique Eyecare Project was established to help answer this need and 3rd level institutes in Ireland and Mozambique are collaborating to find a sustainable solution. The programme is hoped to significantly reduce cases of avoidable blindness in Mozambique and elsewhere in the future.

DIT has joined forces with the University of Ulster and in collaboration with the International Centre for Eyecare Education (ICEE), Lurio University (UniLúrio) in Mozambique, and supported by the Mozambique Eye Care Coalition (MECC — a coalition of NGDO's and Mozambique Ministry of Health) they have established the first optometry course in the country. Sixteen specially selected students have already commenced the programme which is being delivered in UniLúrio. The Mozambican government has welcomed the scheme which supports their current effort to expand and decentralise higher education throughout the country.

The programme will facilitate the development, implementation and evaluation of a regional optometry model for Lusophone Africa. A regional College of Optometry situated at Lurio University campus will act as a centre for undergraduate optometric education and postgraduate research. The countries targeted to benefit from this training program are the Lusophone countries of Angola, Guinea Bissau, Sao Tome e Principe and Cape Verde.

By 2013, more than 45 students will have been trained to deliver primary eye care and refractive services to address the needs of these countries. Implementing, researching and analysing this model will improve UniLúrio's research capacity and provide a strong foundation for optometry education and research in other developing nations. The project was officially launched last June at DIT's National Optometry Centre by Peter Power TD, Minister of State at the Department of Foreign Affairs. The launch marked an important day for all the organisations involved in the establishment of this Irish Aid-funded programme. The North-South strategic cooperation is designed to facilitate capacity development of higher education and research in developing nations.

"The Dublin Institute of Technology takes the provision of Mozambique's only optometry course seriously," commented Professor Brian Norton (President, DIT) at the project launch. "There is a commitment to collaborate with UniLúrio, Portuguese Africa and beyond to assist in the establishment of teaching clinics in developing nations, equal to the National Optometry Centre."

"We are going to launch an effort to create educational opportunities for children in Africa," commented Professor Kovin Naidoo (ICEE), current Chair of the International Agency for Prevention of Blindness (IAPB). "We will be part of a project that is going to create employment opportunities and will impact on the quality of life of the people of Africa. This project is designed to empower Africans and reduce our dependency on aid through sustainable development of human resources."

Research Programme

The research programme is focused on four key thematic areas but it is a multi-disciplinary project of interest to those with a wide range of backgrounds.

Evaluation of a novel, multiple entry, multiple exit, educational model.

This programme designed by Professor Kovin Naidoo will address the human resource challenges facing developing nations. The programme will graduate optometric technicians after two years, officers after 3 years (both eligible to practice only in the local public health system) and optometrists after 5 years including at least 1 full year of clinical practice experience. The merits of the model will be evaluated and lessons learned taken to other similar programmes across developing nations.

Evaluation of a specifically tailored optometry curriculum

This will determine aspects of training most relevant to, or conversely most redundant, in a developing world environment. Teaching techniques and technologies will also come under the spotlight in an effort to determine the most effective training systems going forward.

Research capacity building

This will also be rigorously pursued, exploring strategies to critically engage current faculty, new postgraduate students and future educators into active research involvement, while also focussing on the development of a research infrastructure and framework currently lacking.

Clinical research

Focussed on eye care needs in Africa, this will also be conducted on an ongoing basis. The Principal Investigator Dr James Loughman is interested in hearing from academics, researchers and students of all relevant disciplines who would like to get involved in this project. The nature of many of the research papers and PhD projects will require expertise from outside optometry, so the project partners would like to extend an open invitation to academics and researchers with an interest/expertise in pedagogy, sociology, bioinformatics, clinical research or any other area relevant to the project, to get involved.

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www.dit.ie/mozambique-eyecare
or view the current Facebook page.

[Social, Business & Economic Development]

DIT LAUNCHES COMMUNITY-BASED **RESEARCH INITIATIVE**

DIT's Community Links Programme is made up of seven very different projects, but what they all have in common is a commitment to support communities and individuals to reach their full potential. One of these programmes is the Ballymun Music Programme.

Last November, the Programme released a mini album called "Ballymun Lullaby". This recording features the choir and soloists from Ballymun performing with the national children's choir Cór na nÓg, and the RTE Concert Orchestra, conducted by Dave Brophy.

The music was written by composer Darragh O'Toole while Daire Ni Bhraoin and Darren Scully, both teenagers from Ballymun, collaborated with Darragh to write the lyrics. The CD contains 4 songs and will be distributed nationwide and available to download on iTunes.

The genesis of this project was a concert in the Helix last March when the work was performed with a cast of 250 children singing and playing. The preparation for this concert was captured in a documentary for Lyric FM by Helen Shaw called "Tower Songs" which won a PPI national radio award in October. This concert was so successful and the reaction to the music so powerful that the Ballymun Music Programme approached RTE to discuss the possibility of doing a professional recording.

A DIT/RTE partnership was set up and with DIT Research and Enterprise funding the idea was turned into a reality. This reality has now been released to the Irish public as a stand alone piece of music to be received entirely on its merits. However, whenever this music is played, whether on radio or iPod, purchased in a record shop or on-line, the identity of Ballymun is being re-shaped to depict the new Ballymun — full of talent, opportunity and music.

DIT"s Programme for Students Learning With Communities recently joined the Living Knowledge Network, which is a network of international 'Science Shops'. 'Science shops' are not shops in the traditional sense, nor are they confined to science subjects, rather they are units that coordinate community-based research in response to concerns expressed by civil society. This is usually but not always linked to higher education institutions, where students conduct the research as part of their curriculum.

Over the last year Students Learning With Communities in DIT has begun to gather a list of research questions from community partners who don't have the resources to do the research themselves. These requests for research cover a wide range of topics. Thus, in the spirit of Science Shops, we are starting to match students (undergraduate and postgraduate) to these real-life research topics that relate to their studies. If you are a community member with a question, we can help to formulate it into a manageable research topic. If you are a lecturer looking for a topic for your students' research projects (or a student looking for your own topic) then check out the website on **www.communitylinks.ie/slwc** under Community Research Topics.

The Programme for Students Learning with Communities, as part of a European consortium of partners led by the Science Shop in the University of Groningen, has been awarded European funding under the FP7 programme in the area of Science in Society. The project, called Public Engagement with Research and Research Engagement with Society (PERARES), has been awarded approximately €2.7 million over four years. The Programme for Students Learning with Communities has also been shortlisted for the Taoiseach's Public Services Excellence Awards 2010.

For more information contact: **Dr Catherine Bates** or **Elena Gamble** on **t: 01 402 7616** or **e: slwc@dit.ie**

[News Round-Up]

BECAUSE YOU'RE WORTH IT

Applications for the 2010 L'Oreal-UNESCO UK and Ireland For Women In Science fellowships are now open.

L'Oréal UK and Ireland, the UK National Commission for UNESCO, the Royal Institution of Great Britain, and the Irish National Commission for UNESCO, have partnered together to provide a dedicated UK and Ireland Women In Science Fellowship Programme for women scientists at postdoctoral level to enable and/or facilitate promising scientific research in the life or physical sciences. Four Fellowships will be awarded in 2010 to outstanding female postdoctoral scientists to assist them with their research. The Fellowships, each worth £15,000 (equivalent € for candidates in Ireland), are tenable at any UK or Irish university or research institute to support a 12-month period of research.

The fellowship money can be spent in any number of innovative ways to enable women scientists to further their careers and facilitate world class research — such as buying equipment, paying for childcare or funding travel costs to an overseas conference.

Visit www.womeninscience.co.uk to apply. The closing date for applications is midnight (GMT) 7 April 2010.

INVESTIGATING **CHANGE IN ACADEMIA**

As part of his Doctor of Education, Kevin Kelly, Faculty of Engineering, conducted research within his faculty on the subject of academic change. The substantive issue of his research is published in the chapter on the changing role of universities in a book titled "European Continuing Engineering Education — Conceptualizing the Lessons Learned". This was published recently by SEFI (the Société Européenne pour la Formation des Ingénieurs — European Society for Engineering Education), for further details see: **www.sefi.be/index.php?page_id=125.**

Dr Kelly has postulated the type of university that DIT needs to become so that it can respond adequately and change academically to a fast changing environment. He has developed an evolving story about DIT and the people working in it and has identified the main barriers and enablers to academic change.

He also presented a paper at the IGIP conference in Graz, Austria in September 2009 outlining the opinions of students and staff about DIT and how these stakeholders helped identify the barriers and enablers to change within the Faculty of Engineering. This paper is available to DIT staff at **http://eleceng.dit.ie/kkelly**.

Using qualitative research methods he addressed the concerns that many engineers and scientists have and had significant input from all stakeholders including staff, students, union representatives and international academics. He presented his interim findings at ASEE (American Society for Engineering Education) conferences in the USA and Istanbul in 2007 and at SEFI workshops in Norway in 2006 and Finland in 2007 before making his final presentation at the ASEE colloquium in Budapest last October.

For more information contact **Kevin Kelly e: kevin.kelly@dit.ie**

[Commercialisation]

MEASURING THE POWER OF **COMPETITIVE CYCLING**

Brim Brothers Ltd was started by Dr Barry Redmond of the Dublin Institute of Technology's School of Electronic and Communications Engineering to develop an innovative electronic device for measuring how much power a competitive cyclist is putting into a bicycle. Lance Armstrong used power measurement to guide his training for his seven Tour de France victories, and it is now accepted by all professional cyclists and coaches as the best way to set training goals and monitor performance. However, power meters are very expensive and have to be built into part of the bicycle, so most non-professional cyclists don't use them yet.

As an engineer and a cyclist competing at local club level, Dr Redmond decided that there must be a better way and came up with an idea for a power meter that works by measuring forces between the cyclist's shoe and the pedal. The sensors and electronics are fitted to the shoe, not the bicycle, so it's much easier to use than existing power meters. The patented system uses tiny specially developed force sensors together with miniature accelerometers to measure movement, and a complicated mathematical process runs many times per second to calculate the power from these. Dr Redmond says that the new system has generated a high level of interest among competitive cyclists all around the world, and they receive regular inquiries about when it will be available. He has been working on the development of the system with a business partner for the last two years, and plans to launch the product at the end of 2010.

For information contact **e: barry@brimbrothers.com t: 083 341 2238 w: www.brimbrothers.com**

KILLER APPS FROM **DIT RESEARCH**

The Dublin Institute of Technology and Enterprise Ireland-backed startup Trezur Ltd have partnered to create a series of cutting-edge digital music consumer applications. Technology patented by DIT's Audio Research Group is being commercialised by Trezur as the basis for a suite of 'killer apps' for PCs and mobile devices, allowing music fans to do things they previously couldn't with the music they already have and love. Trezur will unveil these apps in 2010, launching in multiple countries and languages, addressing the worldwide base of half a billion digital music fans. For more information **e: info@trezur.com**

CALLING ALL ENTREPRENEURS **HOTHOUSE VENTURE PROGRAMME**

The Hothouse Venture Programme is open for applications for the 19th programme which commences on 25th March 2010. The programme is a year-long comprehensive support and incubation programme for graduate entrepreneurs with industry experience and a technology-based business idea and runs twice a year March and September.

For more information contact **Sara Hogan** on **t: 01 240 1307** or **e: sara.hogan@hothouse.ie**

POSTGRADUATE STUDENTS AVAIL OF **NEW EUROPEAN MASTER CLASS**

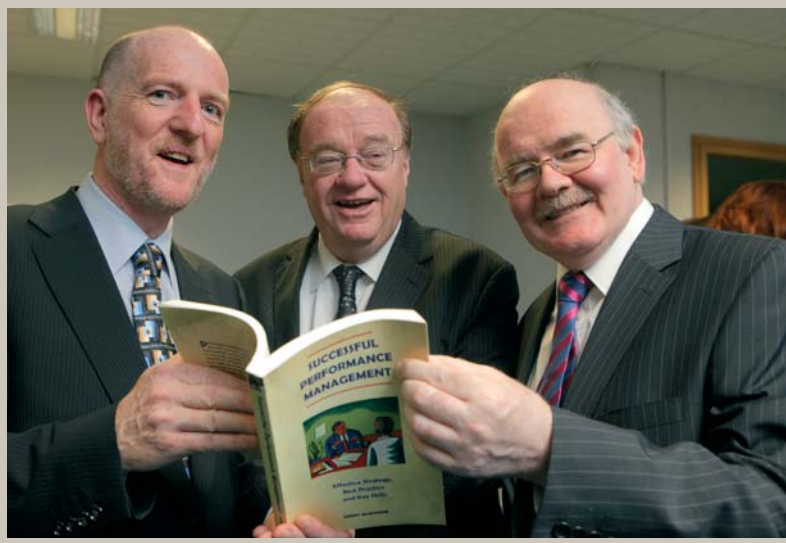
The Faculty of the Built Environment is part of a European training academy for postgraduate students that gives DIT students an opportunity to attend an intensive programme of Master classes delivered by built environment experts from across Europe. The 1st European Built and Human Environment Master classes were held last year in the beautiful town of Telc, Bohemian-Moravian Highlands, in the Czech Republic. The programme is part of an EU-funded Erasmus Intensive Programme for Lifelong Learning open to built environment postgraduate students on either taught or research programmes. Each partner institution provides at least two lecturers for the 2 week course.

As a collaborating institution DIT sent three students to Telc — Laura Farrell and Rudie Dorrepaal (MSc in Spatial Information Management) and Renuka Rajput (PhD student in Construction Management).
The two-week programme consisted of lectures, project work and PhD sessions. The core objective was to provide a multi-disciplinary response to a scenario of an earth quake disaster affecting the town of Telc, a Unesco World Heritage site. The students had to deal with issues such as: short- and long-term response, construction management, spatial planning, logistics, health and safety, design etc.

The project was hosted by the Built and Human Environment Research Institute, University of Salford and (CVUT) Czech Technical University in Prague, Faculty of Civil Engineering. Collaborating partners are: Sakarya University Turkey; Universidad Politecnica de Valencia, Spain; Dublin Institute of Technology, Ireland; Instituto Superior Tecnico-Lisbon, Portugal; CVUT- Prague, Czech Republic; Warsaw School of Economics, Poland; University of Minho, Portugal.

Within the Faculty of the Built Environment, the School of Spatial Planning is the main partner representing DIT in this project. The School has a large number of taught MSc students (Msc in Planning and Development, MSc in Spatial Planning, MSc in Spatial Information Management, MSc in Sustainable Development and MSc in Community and Local Development) who can apply to attend the course. The next two-week programme will take place in the spring of 2010 in Turkey.
For more information contact **e: henk.vanderkamp@dit.ie**

PERFORMANCE MANAGEMENT GETS THE **THUMBS UP**



Performance management' or 'appraisal' systems are the main tool used by employers for planning, reviewing and improving employee performance, determining pay bonuses and developing the performance and potential of staff at work.

Launching his fourth book on the subject in tandem with updated research findings from 250 Irish-based employments, Dr Gerard McMahon, Faculty of Business, informed a Chartered Institute of Personnel and Development seminar that:

- Performance Management is now seen as the top HR priority over the next 3 years by the heads of all organisation types around the world.
- More than 8 out of 10 Irish organisations now use a formal system of performance management.
- More than 7 out of 10 organisations rate their system as effective.

With an international recession forcing employers to get more from less, the issue of employee performance is back with a bang. Just last year the OECD chided Irish managers for not taking such systems seriously, preferring to use them as 'little more than a paper exercise'. This was clearly the case at the Financial Regulator's Office where it has now transpired that — to the cost of many — not alone did top management not know what was happening in the banks, but they didn't even know what was happening in their own organisation!

However extensive research undertaken by McMahon calls into question the generality of the OECD's assertion, arguing that such systems have much merit and are integral to organisational success.

What Are Employers Doing?

Surveying international practices and performance management in over 250 Irish organisations, research for McMahon's book confirms that these systems are now an accepted and reputable practice both nationally and internationally. The rise of performance management is also evident in its extension to practically all employee categories. Furthermore methods of managing performance have changed dramatically in recent years, as reflected in the significant growth of:

- Performance-related pay, which when applied appropriately can enhance performance levels, though when applied recklessly does untold damage to organisations' all-important financial and employee morale criteria

- 360 degree feedback systems, whereby management expose themselves to assessment from their own managers and from staff, peers and customers

- Rating scales, whereby managers periodically 'score' staff on aspects of their performance, with significant — and sometimes explosive — implications for the quality of their working relationship

- Coaching and mentoring schemes, with many features taken from the world of sport

- Joint (manager: employee) objective or target setting systems of work planning and review

- Complex procedures for the dismissal of underperformers

Is It A Success?

McMahon's updated research – from previous surveys in 1994 and 1999 reveals that performance management systems, both nationally and internationally, are judged to be effective. However they are not trouble-free. For example, 'lack of follow-up' (ie after the review meetings) is a common complaint, whilst a preoccupation with the system's paperwork (as opposed to the people), a failure to review or monitor the system, a lack of people skills amongst managers and management subjectivity/ bias, together with the bonus/pay rise linkage inhibit their effectiveness. Having reviewed these pitfalls McMahon's research offers practical routes to their resolution.

The key-determining factor of a system's success is the priority and consequent resources accorded it by top management. Where management are genuinely committed to such systems and are prepared to commit the requisite resources the prospects for success are significantly enhanced. For example, training in staff motivation methods and effective techniques for giving feedback are crucial — but too often neglected skill-sets.

With the worldwide economic downturn spreading fear and cynicism at work, there is no better time for good managers — knowing how to get the best from their staff - to step forward. Dr McMahon's book "Successful performance management: effective strategy, best practice and key skills", is available from Liffey Press.

For more information contact **Dr Gerard McMahon**
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Dublin Institute of Technology

OFFICIAL PUBLICATIONS POLICY SUPPORTING OPEN ACCESS FOR DIT

DIT has mandated all authors/researchers to deposit the full text of their publications (where possible) in the Institutional Repository, Arrow@DIT (Http://arrow.dit.ie). By doing so, DIT supports the Open Access Movement by implementing an Official Publications Policy Supporting Open Access. The decision was made by the Research and Scholarship Committee and ratified by the Directorate, the senior leadership team.

The full text of the policy is available at http://arrow.dit.ie/mandate.html. While the majority of Irish research councils/funders have already mandated authors to make their research available as open access, DIT is the first educational institution in Ireland to do so. A list of institutions who have similar polices can be accessed at: www.eprints.org/openaccess/policysignup. This short article will attempt to explain the importance of making research available on an open access model and some of the issues involved.

What is Open Access and why is it important?

Open Access is a movement to make the results of research activity freely available to all on the web. There are a number of reasons for this.

- Research is supported by public money and the results should be freely available to the public.
- The purpose of scholarly communication is to disseminate the results of research as quickly as possible. This is done faster and more easily on the web than through traditional publishing channels.
- Digital Natives (and indeed Digital Immigrants) are used to finding information free on the web and frequently fail to realise that access to this information is only made possible because their institution has paid for it. As a result of the economic downturn access to such information is becoming problematic as libraries retrench and cut rather than renew journal subscriptions. A striking example of this is the very recent decision by SFI not to renew the bulk of the funding for the Irel project which provided the Universities with access to a vast array of journal information.
- Less traditional and more multi disciplinary activities can find it more difficult to be published in traditional journals.
- A lot of research is collaborative and collaborators can discover each other more easily on the web.
- Personal reputation and that of the institution can be enhanced by publishing to the web.

It has been suggested that Open Access Publishing is of poorer quality than traditional publishing. This is really only relevant as a criticism when applied to some Open Access Journals which can vary in quality. On the other hand, experts in a cutting edge field can come together to publish open access journals as being both quicker and cheaper. In such cases the peer review process can be as rigorous as for traditional journals and the quality similar. However, authors should exercise caution when investigating publishing with an open access journal. It is always advisable to check the provenance of the journal and the quality of the Editorial Board and the home institution.

Open access the death knell of the scholarly journal?

This is the argument often advanced against Open Access Publishing not alone by publishers but also by small scholarly societies who depend on subscriptions. Currently, it is not an either or situation. Both traditional and open access models are operating in tandem. The vast majority of publishers, recognising that scholars do most of the work for them for no economic advantage, permit authors to publish their final versions in institutional repositories and on the web. However, in most cases, they will not permit their published version to be posted. Their argument is that they apply editorial control and management and have an economic investment in the work. There are some exceptions to this such as IEEE (The Institute of Electrical and Electronic Engineers) who permit their published version to be uploaded to repositories. However, it should be remembered that it can take up to 18 months to be published in a peer review journal which does not ensure speedy dissemination of research results. Many of these journals operate very traditional criteria for inclusion in the journal and do not necessarily embrace innovative thinking. The pressure 'to publish or perish' means a great number of authors compete for limited space. Thankfully many of the publishers operate policies that permit the author to publish their own version to the web after acceptance. It is more likely that this permission will apply after the article has appeared in print. Also, it must be pointed out that a small number of publishers will not permit any version to be uploaded. In this case, there will be a citation only in Arrow@DIT with a clear statement that permission to publish has been refused.

Permissions

Authors need to remember that when they signed the agreement with the publisher they will have also signed over ownership of the information to the publisher. This means that even the author cannot use his/her own material without the permission of the publisher. Many publishers will permit books to be uploaded once they are out of print. Frequently, book chapters can also be uploaded as by doing so does not negate the economic advantage to the publishers.

The Library will check the publishers policies in relation to material submitted to Arrow@DIT and ensure compliance. If the publisher's policy cannot be found, the Library will contact them seeking written permission. This has already been done with a number of Irish publishers who have been happy to grant permission. However, the easiest way is for the author to check the publisher's policy once the material has been accepted. This can be accomplished by a simple request for permission to publish the author's final version or if they are agreeable the published version in Arrow@Dit. In all cases, a link will be established to the published version both to verify the fact that it was published and so that those (lucky enough to have a subscription) can access the published article. It is the repository manager's role to ensure that the Institute complies with the publishers' policies. As with any publishing situation the author is required to ensure that the content is copyright compliant.

Versions

There are a number of versions that a journal article goes through in the publishing cycle and it can be difficult to recognise which version should be deposited in Arrow.

- Pre Print: This is the version of the article before it goes through the peer review process.
- Post Print: This is the version of the article after it has been through the peer review process
- Authors Final Version: This the version after the amendments and corrections have been made, the peer review process completed and the article has been proof read by the author. This is generally the version that can be uploaded to Arrow@dit
- Publishers PDF: This is the version as it appears in the journal. It will carry the publishers branding and journal layout. At the very least when signing the copyright transfer form, ask for permission to reserve the right to upload the article to the institutional repository. The Publishers PDF would be the preferred version for long term preservation but failing that, the Authors Final Version will suffice.

More work!

Researchers are very busy people and would like to concentrate primarily on carrying out their research. However, increasingly, researchers have to assume some responsibility for the dissemination of the results of their work. As funding opportunities become more limited, funders are keen to have some indication of the impact of the research. The full text download statistics from Arrow@DIT supplied monthly to each individual author can produce a convincing argument that the research is pertinent and of current interest. The annual statistics produced for each School and Faculty can be very useful for Quality Reviews. As a personal marketing tool, Arrow@DIT provides an author with global publicity providing a world stage on which to promote the research. This can be particularly important if your interest is highly specialised as you can find like minded individuals on the web. Moreover, because Arrow@DIT is an institutional repository it will be regarded as an authorative source since it is provided by an educational establishment. Given all that, the effort of depositing an article seems a small price to pay. Once familiar with the system, depositing a paper takes less than 5 minutes. This does not have to be done by the author but can be delegated to others i.e. research assistants or the library staff.

Simple system

Uploading to Arrow@DIT is a simple procedure. Once an author has created a personal account, he/she can start uploading material. The Library will be happy to help and advise authors, demonstrate the system and advise on copyright and permission issues.

Conclusion

"The power to change is the power to communicate. Communication is what makes the Internet such a powerful thing. The power of the Internet is the power to send letters again. The power of the Internet is the power to revisit language again. Language has a new tool in its toolbox. In there with the words, grammar, quills, pens, ink, typewriters, now can be found the Internet. Language and its communication is reinvigorated by the Internet." (McGovern, Gerry)

This extract is from an article by Gerrry McGovern entitled The Power of Communication written in 1997. McGovern is regarded as one of the visionaries who helped developed the web. The power to communicate he talked about is now matched by the ability to retrieve information on a global scale. What McGovern saw as a power is now an unstoppable force. Institutional repositories in general and Arrow@dit.ie in particular are part of that force. Depositing material in an open access repository ensures communication will not only take place but will be preserved for future generations.

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NANOTECHECHNOLOGY AND SENSORS

A.C. Power, J.F. Cassidy and A.J. Betts, Applied Electrochemistry Group, Focas.

Analytical chemistry and analytical techniques are essential tools in the investigation of the physical world surrounding us, enabling us to gain a better understanding of how it functions. This has resulted in a marked increase in the demand for information, and with it an increased interest in the development of sensing devices and sensors. Emphasis is usually placed on the improvement of their key elements of selectivity, sensitivity, reversibility and rapidity of response [1].

Nanomaterials (materials of the nanoscale — between 1–100 nanometres, where 1 nanometre corresponds to one billionth of a metre), especially metallic nanostructures, often display novel physical and chemical properties when compared to their bulk counterparts [2].

This 'nano world' can be described as the area between the realm of individual atoms and molecules (where quantum mechanics rules) and the 'macro world' (where the bulk properties of materials emerge from the collective behaviour of trillions of individual atoms). This affords the 'nano world' a flexibility, where set laws of the macro scale may be manipulated and distorted to suit a project's needs. However this does not give the 'nano world' the free reign of infinite possibilities, which is often portrayed in popular culture. There are rules and limits in nanotechnology's future even if it is simply due to their scale, for although it can be accepted that the smaller a device is, the more susceptible its physical properties are to alteration. This very strength or opportunity, could also be a significant weakness [3].

This overriding goal to 'make things smaller' has contributed to a worldwide fascination, to the extent that 'nano' has become a buzzword unrestrained from iPods to cars. The 'nano' age has dawned. Recently, various techniques for the fabrication of nanostructures have been developed [3].

This coupled with what may be considered the overriding aim of all modern analytical chemistry, the escalating need and desire to monitor all aspects of our environment in real time coupled with the ambition to determine both contaminants and analytes at lower and lower levels, [4] has resulted in the development of numerous 'nano' based sensors. Previously, polymers have been widely utilized in a wide range of sensing devices with definite roles, either in the sensing mechanism or through immobilizing the species responsible for sensing of the analyte component. This is possible as polymers may be tailored for particular properties, are easily processed, and may be inert in the environment containing the analyte (chemical species of interest). Coupling nanoparticles with specific polymers within nanocomposites is very effective in producing highly selective and sensitive gas sensors [5].

In a recent study conducted by the Applied Electrochemistry Group a series of nano silver and polyvinyl alcohol (PVA) composites were developed and characterised, before being cast as sensor coatings onto an interdigital array. These (PVA) silver nanoparticle composite based electrochemical sensors were found to be well suited to humidity detection. The sensors' response is reversible and fast at room temperature and it displays a high selectivity.

The silver nanoparticles were synthesised by a chemical reduction of silver nitrate by sodium borohydride in an aqueous media with polyvinyl alcohol (PVA) utilised as the capping (stabilising) agent. The role of PVA as a successful capping agent is well documented [6].

It was also observed that without the presence of the PVA, the stability of the colloids was drastically reduced with metallic silver formed due to aggregation of nanoparticles. Widely used for polymer nanocomposites due to its water solubility, it is virtually non-toxic [7].

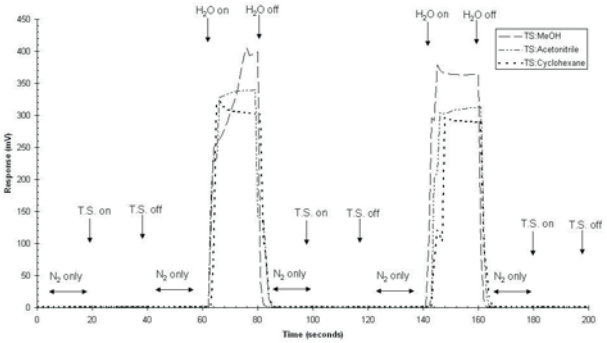

Figure 1.

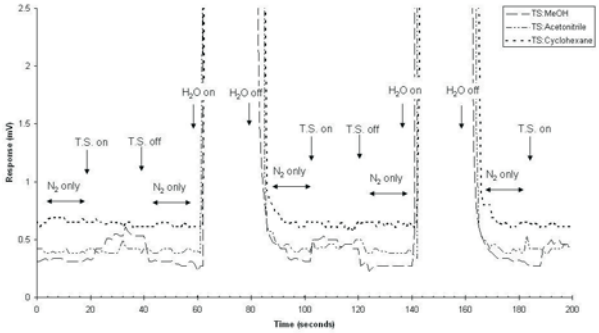

Figure 2.

Several analytical techniques including UV-Vis spectroscopy (UV-Vis), Dynamic Light Scattering (DLS), and Transmission Electron Microscopy (TEM) determined that the silver nanoparticles synthesised were spherical, and had an average particle size of 21-22 nanometres. The nanoparticle composite when cast on an interdigital electrode array and upon application of a constant potential, was observed to produce a current, which was proportional to levels of humidity from 10% RH to 60% RH. The sensor gave a reversible rapid response at standard temperature and pressure. The steady state response was selective and increased with increasing levels of humidity. A clear response for water vapour was observed with no obvious response for other non-polar vapours such as cyclohexane, as shown in Figures 1 and 2.

Figures 1 and 2 illustrate clearly the response of the sensor in different environments, initially the sensor is exposed to a dry nitrogen gas (N2) stream (neutral environment), then a stream of a test solvent vapour is put across the sensor before being replaced again by the dry N2 finally the sensor was placed in a water vapour gas stream. It can be seen from Figures 1 and 2 that there is a dramatic difference in response between water and another quite polar vapour, methanol confirming its high selectivity. On magnification of the response (Figure 2) there is a small negligible peak due to methanol (and another polar solvent acetonitrile).

Thus a gas (humidity) 'nano' silver polymer sensor was successfully developed which exhibited many of the qualities of the ideal sensor, i.e. good selectivity, high sensitivity, reversibility with a rapid response/ recovery time at standard temperature and pressure (everyday conditions).

Acknowledgements

A.C. Power thanks the ABBEST PhD Scholarship Programme of the Dublin Institute of Technology, and everybody in the FOCAS Institute/DIT for their assistance during the experimental process

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EQUIENDO AND EVENTOVATE MAKE IT INTO **TECHCRUNCH EUROPE TOP 100**

Hothouse Venture Programme Graduates

DIT Hothouse Venture Programme graduates, Equiendo and Eventovate have made it into the prestigious TechCrunch Europe Top 100. This is a regularly updated Index of the most innovative and highest-potential European tech companies.

Listed in the top 20, Equiendo is an exciting Irish company that provides intelligent software solutions to the mobile telecommunications industry. The company's product EquiTraf is designed to help mobile operators deliver a high quality of service across their networks while keeping control of their costs. Founded in 2005, last year Equiendo raised € 1.5 million from investors to finance expansion into the European market. The first round funding came from Enterprise Ireland and a number of private investors from the telecoms industry, among them ex-O2 chief technical officer Oliver Coughlan, who joined the firm's board.

Graduating from the Hothouse Venture Programme in 2009, Eventovate is Europe's leading provider of software services to the wedding venue market. They specialise in empowering hotels to accelerate their wedding business through value innovation, cost reduction, service automation and performance optimisation. In June 2009 the company raised € 500,000 from two investors in the UK and US doubling the existing amount of funding already secured through Enterprise Ireland and the Seed Capital Scheme.

The Hothouse Venture Programme is currently recruiting sixteen tech start-ups for its next programme beginning March 25th 2010. This year long programme offers participants:

- Free office space for 1 year
- Ten sessions with a business mentor
- Workshops on key business topics
- Access to funding

The deadline for receipt of applications is Friday March 19th.
For more information contact **Sara Hogan, t: 01 240 1307 e: sara.hogan@hothouse.ie** or go to **www.hothouse.ie**

[Social, Business & Economic Development]

NITL INVITED TO JOIN EUROPEAN **NETWORK OF EXCELLENCE**

New member of the "Open ENLoCC" (European Network of Logistics Competence Centres) network

DIT's National Institute for Transport and Logistics (NITL), part of the Faculty of Engineering, has been invited to become a member of the "Open ENLoCC" (European Network of Logistics Competence Centres) network, which is a consortium of regional logistics centers of excellence in Europe. The network has been set up as part of an INTERREG IIIc project, partly co-financed by the European Commission, and has members from across the European logistics and supply chain arena.

The aim of the network is to increase Inter-European cooperation of logistics institutes and organisations — in industry and science — by sharing experience and by working together on common logistics projects. The network aspires to develop innovative systems and technologies in transport and logistics, as well as to advance regional economies by solving infrastructural, organisational and technological problems in logistics and transport. On a European policy level, the network's purpose is to contribute to European harmonisation of law, technology and standardisation in transport and logistics and to support the foundation of new regional logistics competence centres (LoCCs). Among other actions, the members of ENLoCC are promoting the development of three major topics in the field of logistics:

- **LOGPLAT**
- **LOGtraining**
- **LOGTEN-T**

LOGPLAT is a communication and information tool for selected groups of players in transport logistics, supporting sustainable regional development and wherever possible, intermodality. It consists of information provided by project and network partners and interfaces or links to external IT-solutions/sources of information. Its primary function is the pooling and categorisation of information to give the user fast access to the latest information and tools as well as to present user's own information in an organised way.

LOGTRAINING is developing an interregional concept of education in transport logistics. Existing facilities, the newest technologies and theoretical approaches will be integrated. Also experts and facilities from the other partner regions will also be incorporated. The possibility of training periods, fieldtrips and exchange programs will guarantee a European oriented education.

Within **LOGTEN-T,** Open ENLoCC members cooperate on questions regarding freight transport along the main European transport corridors. So far, the main emphasis regarding these corridors has been given to (fast) passenger transport. However, freight logistics will be given equal importance in future work.

Open ENLoCC currently has members from the Czech Republic, Austria, Finland, Italy, France, Germany, Poland, Hungary, Sweden and Slovenia. NITL is its first Irish partner.

For further information, please contact **Dr Claudia Wagner**
e: claudia.wagner@dit.ie

ELECTROCATALYSIS FOR DIRECT **ETHANOL FUEL CELL**

D. Fox, A.J. Betts, J. Cassidy
Applied Electrochemistry Group, Focas

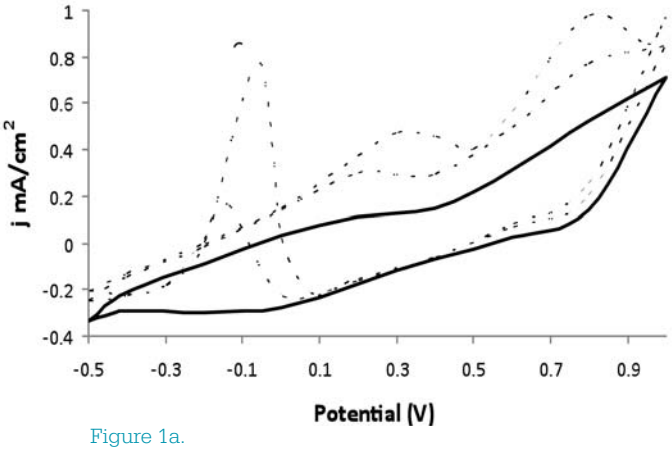

Figure 1a.

Biofuels such as bioethanol have seen an increase in interest across the world (1), including the development of two industrial-scale processing plants in Ireland. Aside from their use in combustion engines, another potential use is in Direct Ethanol Fuel Cells (DEFC) where they can act as power sources for portable devices such as laptops, mobile phones and cameras replacing batteries (2).

Ultimately DEFCs could even replace the current automobile internal combustion engine. Two main driving forces behind fuel cell research are environmental and economic factors, and as a result many different fuel cells have been developed for a wide variety of conditions. These range from the Solid Oxide fuel cell (with an operating temperature of over 800°C) for large power sources, to the low temperature DEFC used in portable applications which is the basis of our research in AEG. In general fuel cells operate by creation of a current as a result of electrochemical reactions at two separate electrodes. Although various fuels have been used in different kinds of fuel cells (such as methanol and formic acid), most research still focuses on the classic fuel cell powered by hydrogen.

The initial attraction of the DEFC is its ease-of-use. Liquid ethanol is far more easily stored and transported than hydrogen. However a major further attraction is the net energy output compared to the classic hydrogen-based fuel cell. The storage efficiency of hydrogen has been calculated as only 0.65% compared to about 95% for methanol and ethanol; with ethanol providing more energy at 26.8 MJ/kg to 19.8MJ/kg provided by methanol. Ethanol however is considerably more difficult fuel to oxidise and the fuel cell requires a good catalyst to help carry out this process. However most catalysts developed to date involve significant levels of very expensive platinum. This is a noble metal which combines desirable properties, such as stability in acids and at high temperatures with enhancement or catalysis of the electrochemical ethanol oxidation reaction. Complete oxidation of ethanol provides the maximum energy or power output.

Ethanol is a molecule made up of different chemical bonds. The strength of these bonds determines how easy it is to oxidise the molecule. Ethanol contains carbon, hydrogen and oxygen bonded to each other. The carbon-carbon bond present provides an opportunity whereby multiple possible reactions can occur and subsequently multiple possible pathways and intermediates may be formed (3). In contrast methanol lacks this carbon-carbon bond and therefore reacts easily. However methanol is much more toxic than ethanol. In the case of a pure platinum catalyst, the performance of the catalyst and hence the fuel cell itself is considerably impacted from a theoretical performance of 85% to approximately 41% and the complete oxidation reaction is severely restricted. Intermediate chemical compounds readily adsorb onto the pure platinum surface, blocking the surface and hence impairing performance.

The current voltage behaviour for ethanol and methanol are shown in Fig 1a and 1b respectively. Starting at -0.5V, the voltage is swept to +1.0V; the organic molecule adsorbs to the catalyst surface in both cases at approximately -0.1V where the current begins to increase. Methanol is easier to convert completely to carbon dioxide at a platinum catalyst and as a result, the current observed is triple that observed for the initial peak observed with ethanol as a fuel. Sweeping back from +1.0V, a current peak is observed as an intermediate molecule, carbon monoxide is oxidised at approximately 0.0V. With increasing time and sweep number, the current continues to increase and the currents associated with intermediates also increase. Using ethanol, the platinum surface is less capable of cleanly breaking the molecule and numerous features are observed. The two peaks on the way forward in Fig 1a are due to the formation of adsorbed intermediates as the surface attempts to break the ethanol molecule, forming acetaldehyde at 1.0V.

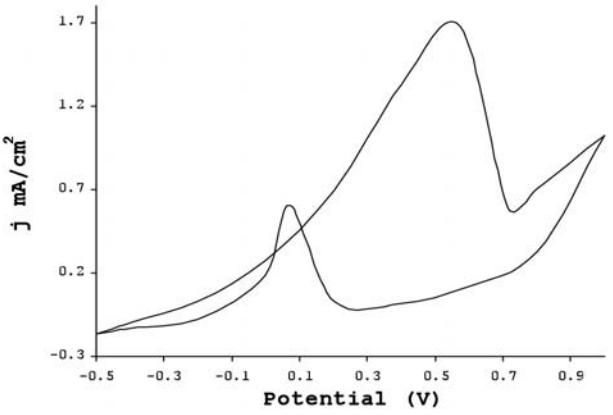

Figure 1b.

The composition of the electrode surface then determines how this acetaldehyde breaks up into further intermediates or alternatively goes to form the full oxidation product, carbon dioxide. Modification of the surface is therefore critical to catalyst research. This improvement can be obtained in numerous ways; however the most popular is the alteration of the surface by alloying with another metal, typically a less expensive metal such as ruthenium, nickel, copper and iron.

Historically fuel cells have used either powerful acid or base solutions, such as sulphuric acid (used in lead acid batteries) or caustic soda (sodium hydroxide). In acid solution however, alternatives to platinum have proven very difficult to find. One suitable metal, palladium, is affected by the strong acid conditions and in basic solution, the final desired end product causes the formation of a hard substance effectively blocking the catalyst with increased production, inhibiting development. In contrast in neutral solution, both extremes are avoided and current is significantly increased, approximately fourfold. The same signature peaks are observed.

For the ruthenium-deposited electrode, the current increases for the start of ethanol oxidation and this is characteristic of improved or modified catalytic surfaces. The extent to which the surface is roughened and possesses certain surface features enhancing its surface area is critical to the performance of the catalyst as the greater the surface area, the greater the effect on catalysis (4). The phenomenon is largely a surface effect. Different metals work in different proportions and ruthenium has been found to work at high percentage content, compared to that of tin which works best at relatively low levels. An ideal catalyst will be one which improves the current obtained at an electrode with either minimal or no platinum content, retaining the desirable properties of platinum mentioned earlier (stability and catalytic activity). Hence reduction of the prohibitively high cost of platinum-rich catalysts is a strategic goal of this research.

Conclusion

Biofuels offer a viable alternative to the classic hydrogen-based fuel cell, but require development and research to maximise their output. Potassium nitrate as a neutral solution offers an alternative pathway to historic highly acidic and highly alkaline conditions of a fuel cell. The current observed experimentally is increased relative to that obtained in both in acid and base conditions. Alloys are being developed to enhance the performance of the catalyst to break down the ethanol molecule and the modify the electrode surface.

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NEW HEAD OF RESEARCH PLANS TO TARGET **EUROPEAN FUNDING OPPORTUNITIES**

Dr John Donovan has been appointed DIT's Head of Research, succeeding Dr Steve Jerrams who has moved to the Centre for Elastomer Research in the College of Engineering and the Built Environment.

John studied Biochemistry in UCG and completed his PhD in Molecular Biology with Professor Frank Gannon. John was appointed Gästewissenschaftler (C1 Professor) at the University of Frankfurt am Main in 1986 and subsequently was a SERC Senior Research Fellow in Biochemistry and Molecular Biology at the University of Leeds in the UK. Returning to Ireland in 1992, John worked in St Luke's Institute of Cancer Research before becoming the 1st Executive Secretary of the Irish Research Scientists' Association (IRSA). IRSA lobbied on behalf of researchers in Ireland which successfully led to the establishment of both SFI and PRTLI. In 1999 John was appointed External Services Manager at the Limerick Institute of Technology. He returned to Dublin in 2002 as DIT's Head of Industry and Innovation Services in the Faculty of Applied Arts. Before his present appointment, John was one of the Heads of Research Support Services in DIT.

While research is increasingly important in a modern Higher Education Institute (HEI), the desire by funders to try to establish the value of their investments in research means that research management must become an increasingly professionalised activity. The increasing demand for information could easily get in the way of promoting a strong research ethos in the Institute. The job of the research manager and, ultimately, the research support services is to keep as much of the pain away from the front line as possible. "I am committed to the Directorate of Research and Enterprise (DRE) as a 'Service Directorate'" says Donovan" I do not see DRE's role in determining who can do what but rather knowing what we do well and supporting our successful researchers and entrepreneurs".

Critically, in DIT research is intimately tied to technology and knowledge transfer and to turning our technologies into successful Irish companies and jobs. Historically, the universities have not seriously engaged with enterprise. DIT has an outstanding track record in technology transfer (four times better than your average European University) and our enterprise development programmes (collectively known as Hothouse) have generated more than 1000 jobs in the last ten years.

"We cannot be complacent, in straitened times we must compete smarter to improve our track record".

Research in Ireland is in a dramatically different place to where it was even 2 years ago. There is less national funding available and what is available is being swallowed up by existing commitments. SFI has indicated that over the next few years there will be up to 500 fewer researchers funded in Ireland. These changes will profoundly affect how DIT researchers can attract funds. Historically, DIT has focused on supporting national priorities and has used national funding do this. "European opportunities are growing and are likely to be the only growth area in the medium term. DIT must make the most of this opportunity."

Finally, Donovan maintains that despite it all, DIT is in good shape to grow its research and enterprise activities. "Innovation is never a linear process, but DIT clearly is doing research that a lot of people are interested in. Whether they want it for new jobs, products or services or for state of the art training, DIT will continue to be at the front.

Hothouse
where business meets innovation

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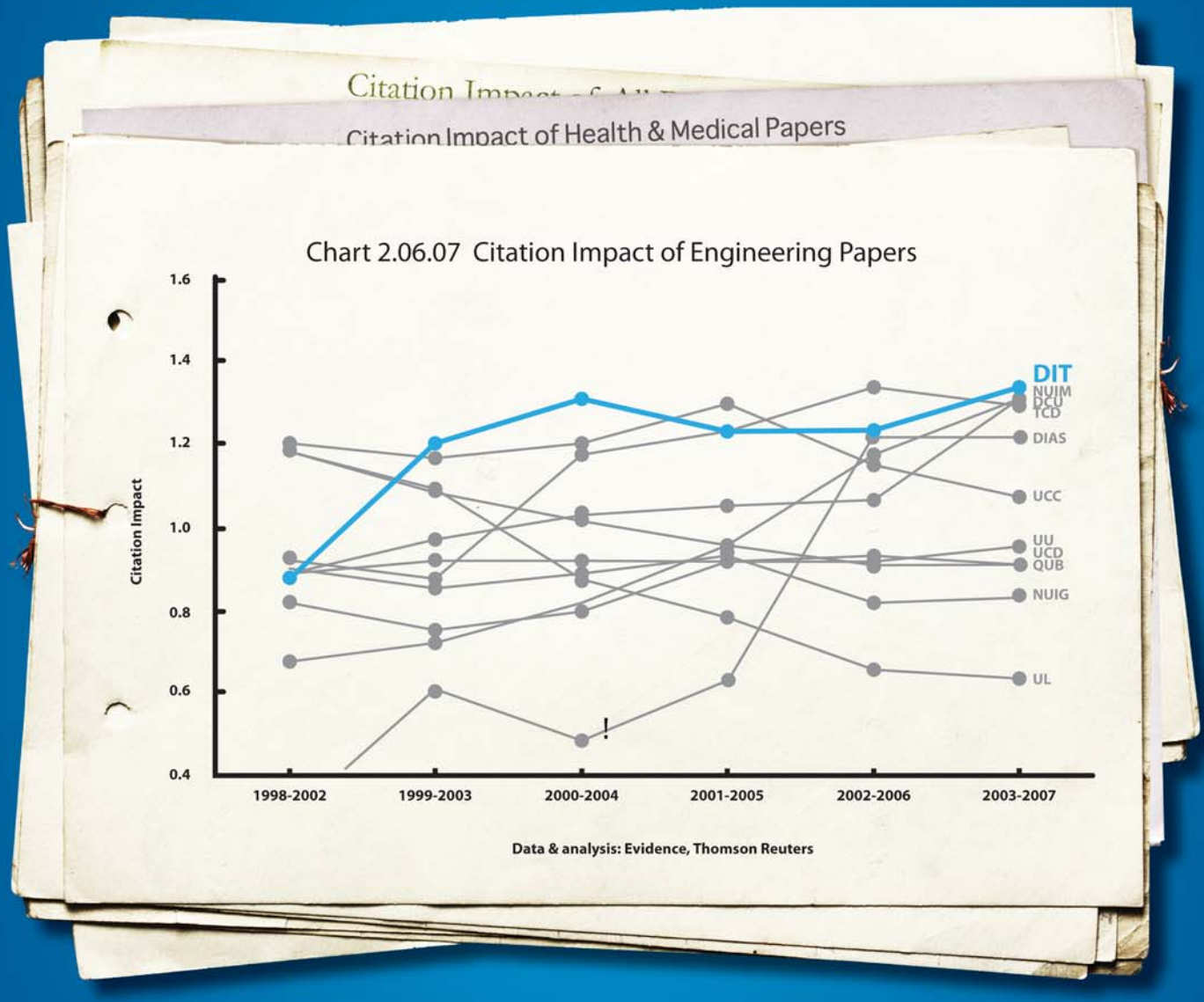

Research volume can be impressive, but research strength lies in the impact it has in its field. A recent study of research strengths in Higher Education institutions in Ireland* measures the citation impact across all disciplines.

The evidence shows that DIT research has serious impact.

*Research strengths in Ireland: A bibliometric study of the public research base – Forfás/HEA, December 2009

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