Building a Dedicated Clinical & Translational Research Network

Peter Doran
Director, UCD-Mater Clinical Research Centre

The recent report “Towards Better Health; Achieving a step change in Health Research in Ireland” from the Advisory Council for Science Technology and Innovation calls for an integrated coherent strategy for health research in Ireland with a view to increasing the performance and exploitation of health research, to improve patient care and contribute to the development of the knowledge economy. The creation of such a coherent strategy is a significant challenge that is being addressed, at least in part, through the unique partnership between the Irish Medical schools that has led to the creation of the Irish Clinical Research Infrastructure Network (ICRIN).

Funded by the Health Research Board and the Health Services Executive, ICRIN will serve to harmonise the operational activities of both the existing clinical research facilities and those that are currently being developed. The creation of an operational network between these facilities will ensure the delivery of the coherent strategy envisioned in the ACSTI report. Clinical Research Facilities (CRFs) are at differing phases of development nationally. Recent initiatives by the HEA, HRB and the Wellcome Trust have greatly advanced our national capability and capacity for translational research by providing both the physical environment within which to carry out this work and also funding the training and employment of skilled personnel necessary to ensure that it becomes a truly relevant and valuable research resource.

The CRFs provide dedicated space to conduct detailed phenotypic assessments and collection of biological samples as well as state-of-the-art environments for clinical trials and investigations. Dynamic bi-directional links between basic scientists and clinician investigators, who share the common goal of improving patient care and patient outcome, are well established with the university research institutes affiliated to the teaching hospitals. Clinical research staff through a multidisciplinary team effort work together to create a scientific and caring culture for the benefit of patients and with the common goal of developing new cures for chronic diseases. Through ICRIN, the CRFs developed throughout the country will collaborate to provide a dedicated clinical and translational research network to deliver on our major strategic aims: the improvement of patient care and the further development of the knowledge economy.

UDC Clinical Research Centres Update

The UCD Mater Clinical Research Centre (CRC) was established in 2006 through an award to the DMMC from the Higher Education Authority’s Programme for Research in Third Level Institutions (see...
DMMC News, Nov 2005). The CRC now has over 40 research projects, including studies of stroke, cancer, HIV, lung disease, diabetes and retinal transplantation. These projects are featured in the Centre’s recently published 2006 Annual Report. Research breakthroughs include the identification of a gene that causes stomach cancer and the use of novel medical devices for sufferers of chronic lung disease. Almost 2,000 patients participated in these projects between April and December 2006. This ongoing work at the centre is having a considerable impact on the patient experience within the Irish healthcare system.

The official opening of the UCD St Vincent’s Clinical Research Centre took place on 23 April 2007. The Minister for Education & Science, Mary Hanafin TD, opened the Centre, which will enable scientists to share and compare genetic data from Irish patient populations with data from patient populations worldwide. According to Dr Hugh Brady, President of UCD, maximising the synergy between clinicians on hospital sites and bench-based scientists is vital for the success of translational medicine. “This investment by UCD in partnership with St Vincent’s University Hospital, the Dublin Molecular Medicine Centre and the Higher Education Authority delivers an integrated clinical network, and enables UCD to play a leadership role in the provision of Irish clinical networks through the auspices of the European Clinical Research Infrastructure Network,” he said.

A DMMC International Workshop in the very topical area of epigenetics research and its clinical applications took place in O’Reilly Hall, University College Dublin from 25-26 June 2007 [1].

The International Workshops are a new strand of DMMC activities. Scientists working in rapidly developing and strategically important areas of translational research link with the cross-institutional DMMC Education & Training Section to put together and realise comprehensive state-of-the-art reviews in the form of intensive workshops. These benefit from a combination of local and international expertise, with attendance open to Irish and overseas scientists and clinicians. The aims are several: an educational offering for postgraduate students and postdoctoral researchers (interacting with international experts, and presenting their own work); an opportunity to initiate collaborative research; promoting particular research areas; and increasing awareness of the Irish molecular medicine research community in general.

Dr Amanda McCann (University College Dublin) and Dr Steven Gray (Trinity College Dublin) devised and brought to fruition this first DMMC International Workshop, *Epigenetics: From Mechanisms To Medicines*. Epigenetics describes mechanisms and phenomena that affect the phenotype of a cell or an organism, but do not involve changes in the DNA sequence. The modifications of the protein and DNA components of chromatin (the packaged genetic material) that constitute epigenetic changes can be transmitted through multiple generations. Thus, there exists a hereditable information system in addition to DNA sequence — the epigenome — that can account for the complexities of human development and disease causation, and that can be affected by environmental factors. As we delve into the causes of disease at the molecular level, the importance of epigenetics is increasingly evident [2,3].

98 registered participants attended the workshop, together with 20 lecturers and representatives of sponsor organisations. Over half of the participants travelled from overseas, with the UK, Germany,
Day 1: Epi-Mechanisms

Day 1 of the workshop covered epigenetic mechanisms and research techniques, and included three of the five scheduled poster talks selected from 30 submitted abstracts. The first session, Chromatin, comprised talks by Prof Wolf Reik (Babraham Institute, Cambridge, UK) on the mechanisms of epigenetic reprogramming, and Prof Kevin Sullivan (NUI Galway) on epigenetic aspects of centromere inheritance and function. In session 2, Prof Orla Sheils (Trinity College Dublin) and Dr Carole Charlier (University of Liège, Belgium) covered the very topical area of RNA as a Regulator. Session 3, on Histone Modifications, began with Prof Bryan Turner (University of Birmingham, UK) presenting a broad view of the functional effects of histone modifications and the challenges of developing an informative epigenetic code. Prof Stuart Schreiber (Broad Institute of Harvard & MIT, USA) described the development of an academic drug discovery platform based on small molecule modulators of chromatin-modifying enzymes. Techniques workshops covered the analysis of DNA methylation, using both a DHPLC screening strategy (Dr Antoinette Perry, TCD), and capillary electrophoresis mobility shift (Dr Mark Lynch, Applied Biosystems). The Day 1 Keynote Lecture, sponsored by AIB, was given by Prof Marcus Pembrey (UCL Institute of Child Health, UK) who presented epidemiological data supporting sex-specific male-line transgenerational responses that suggest epigenetic inheritance.

Day 2: Epi-Therapeutics

Day 2 of the workshop concentrated on epigenetics in development and disease. The scene was set with an Introduction to Epigenetic Drugs comprising overviews of DNA methyltransferase inhibitors (Dr Helen Gallagher, UCD) and histone deacetylase inhibitors (Dr Steven Gray, TCD). Session 5, on Stem Cells, began with Dr Kay Nolan (UCD) placing epigenetics and stem cells in context. Dr Joyce Ellen Ohm (Johns Hopkins University, USA) presented data on stem cell chromatin patterns that may represent a blueprint for DNA hypermethylation and heritable gene silencing and reflect a stem cell origin for adult tumours. During session 6, on Environment Interactions, Prof Michael Skinner (Washington State University, USA) discussed work on endocrine disruptors that suggests that environmental factors can reprogram the germ line to induce epigenetic transgenerational disease states. Dr Dana Dolinoy (Duke University Medical School, USA) presented studies on the effect of endocrine active compounds on the foetal epigenome.

Session 7 was on Epigenetics and Disease. Prof Eamonn Maher (University of Birmingham, UK) discussed clinical studies suggesting the possibility of epigenetic changes in imprinted genes following Assisted Reproductive Technology (ART) protocols. While the absolute risk of an imprinting disorder following ART appears to be very small, further research is required into long-term health outcomes. Prof Allen Yang (Norris Comprehensive Cancer Center, USA) presented data showing DNA methylation changes correlating with clinical features in haematological malignancies. Dr Hoon Ryu (Boston University School of Medicine, USA) discussed the therapeutic potential of targeting the epigenome in neurodegenerative conditions. Dr Amanda McCann (UCD) presented data on alterations in the imprinting phenotype of alpha-T-catenin in urothelial cell carcinoma of the bladder and in breast cancer.

Day 2 of the Workshop included the final two poster talks and the judging of posters. The winner of the best poster talk, ‘Loss of IGF2 imprinting in breast and colorectal cancer is a somatic epimutation rather than a congenital event’, was Dr Adele Murrell (University of Cambridge, UK) and the best poster prize went to Ms Angela O’Gorman (National University of Ireland, Galway) for the poster entitled ‘IκB-α as a target for epigenetic silencing in colon cancer’.

The Workshop concluded with a Keynote Lecture sponsored by the Irish Cancer Society, given by Prof Peter Jones (USC / Norris Comprehensive Cancer Center, USA) on cancer epigenomics, stressing the major role of epigenetic silencing of tumour suppressor genes in human carcinogenesis. This provided an excellent conclusion to an intensive workshop programme that brought together some of the most recent research on how epigenetic regulation occurs, the many aspects of development and disease in which it factors, and the therapeutic potentials in human disease. We thank our sponsors for their generous support of this DMMC International Workshop: the Irish Cancer Society, Diagenode, Merck Sharp & Dohme, Brennan & Company, Cambridge Bioscience, Whatman, Applied Biosystems, Enterprise Ireland, NimbleGen Systems.
The search for genes that contribute to common complex disorders has moved into the era of whole genome association (WGA) studies. In recent months the leading scientific journals have published a series of WGA studies of common genetic disorders such as coronary heart disease, type 2 diabetes, Crohn's disease and breast cancer. These studies are dramatically changing our understanding of the genetic aetiology of these common diseases as the identification of novel genes provides new insight into disease pathophysiology.

WGA studies predominantly target the most common type of DNA nucleotide variation, the single nucleotide polymorphism (SNP). A traditional association study compares the frequency of a SNP in a sample of cases (patients/affecteds) versus a sample of normal controls (unaffecteds). Where a significant difference in SNP allele frequency at a gene is observed between cases and controls, that gene is said to be associated with the disorder and thus implicated in disease biology. A defining feature of WGA studies are the very large numbers of SNPs tested for association. The new Affymetrix® Genome-Wide Human SNP Array 6.0 can test 906,600 SNPs in one experiment, and this number is increased several fold when linkage disequilibrium information is incorporated into the analysis. Thus, the technology is approaching completeness for coverage of all common SNPs across all genes in the genome.

A second defining feature of WGA studies is the very large number of DNA samples required for analysis. Common genetic disorders are often described as complex because they are not inherited in a strict Mendelian manner and are thought to be caused by numerous genes acting in combination with environmental risk factors. In isolation, each of these genes only has a small effect: carrying the risk allele at a SNP that causes e.g., an amino acid change that disrupts normal protein function, may only result in a marginal increase in an individual's overall risk of developing the disorder. The small effect sizes of these genes means that very large case-control samples are required to detect them, ranging in size from 1,000's to 10,000's of samples.

WGA studies represent explosions of data that require dedicated information infrastructure to securely and accurately store the data, and specialised biostatistical software to analyse the data. In the Neuropsychiatric Genetics Research Group, we are currently collaborating on WGA studies of schizophrenia and attention deficient hyperactivity disorder (ADHD). To facilitate these studies and others we have put in place a Biocomputing Platforms SNPmax data management system, supported by the Trinity Centre for High Performance Computing, which has the capacity to handle the billions of data points generated by a WGA study. We are currently setting up a WGA genotyping platform in collaboration with UCD that will generate data for an international multi-centre WGA study of autism. In addition, we are developing systems biology approaches to 'mine' WGA data for evidence of specific pathway involvement in common disorders.

Do WGA studies represent the beginning of the end of the association study? It is more likely that we have just reached the end of the beginning. Interest has already moved on to structural variation in the genome, e.g., copy number variants, and the overall impact of rare genetic variation in common disorders. Whole genome sequence on patients is only a short time away. The real challenge now is to translate significant p values from the genome into functional effects on the transcriptome and the proteome, and thus translate WGA studies into improved diagnostics and therapeutics for common disorders.

References
1. DMMC International Workshop  
   Epigenetics: From Mechanisms To Medicines  
   (25-26 June 2007, Dublin)  
2. Nature Insight: Epigenetics  
3. Cell Special Review Issue:  
   Epigenetics and Chromatin Organization  
   (23 February 2007: Vol 128, No 4)
PhD programme in the 2006/2007 academic year. All incoming doctoral candidates now register on this accredited system, which is supported by new regulations and policies. In parallel with the introduction of the new PhD system, the 2006/2007 academic year also saw the re-organisation of graduate studies in UCD under the auspices of five Graduate Schools allied to the University’s five Colleges. A key feature of the new graduate programme is the provision of taught modules designed to facilitate the student in carrying out more successful research and enhancing their professional skills for life long career development. These modules are accredited in accordance with the European Credit Transfer System (ECTS) and enable graduate students to tailor their education to their own specific needs over the duration of their research.

To support these developments within the College of Life Science Graduate School, The Conway Institute has expanded and adapted its graduate education programme to provide accredited modules tailored to the needs of laboratory-based researchers in the life sciences. Three of these modules, the Introduction to Core Research Skills, Advanced Research Skills for Biological Scientists and Communication for Research Scientists are designed to provide students with the knowledge and skills necessary to effectively implement their research in accordance with the highest ethical standards and an awareness of its potential social and commercial impact. The 5-credit Introduction to Core Research Skills module, which students take in the first semester of their graduate programme, introduces them to key aspects of project design, organisation and management as well as familiarisation with bibliographic and internet tools, how to communicate research effectively and understand the relationship between research outcomes and intellectual property. It also includes half day sessions on health & safety, the use of graphic and presentation tools, ethics in biomedical research and career development.

This is followed in the second semester by Advanced Research Skills for Biological Scientists (2.5 credits) which encompasses 10 half day workshops where the students learn how to apply analytical and statistical skills to their experimental data, how to patent and commercialise their research findings, appreciate the ethical and professional obligations of scientific researchers and the broader social impact of their research. Delivery of Communication for Research Scientists (2.5 credits) spans several semesters as it is designed to meet the needs of students as they progress through their doctoral studies programme, starting in semester two with workshops on writing scientific abstracts and papers, this module progresses through sessions where students learn to present their work to specialist and general audiences, prepare their doctoral thesis and apply for research funding.

The past year has also seen the modularisation and accreditation of the Conway’s post graduate courses in Neuroimmunology and Immunobiology, the latter being held in St Vincent’s University Hospital and run in conjunction with the DMMC. A new and very popular addition to the programme was the Introduction to ‘omic’ and advanced imaging technologies (2.5 credits) module which familiarised students with the principles, practice and application of bioinformatics, proteomics, genomics and imaging.

**TECHNOLOGY UPDATE:**

**UCD Conway Institute Mass Spectrometry Resource**

The UCD Conway Institute Mass Spectrometry Resource (MSR) is a state-of-the-art facility that supports the proteomics research within the Institute, with the aim of identifying proteins and their modifications that play important roles in fundamental biology in health and disease. The MSR activities are coordinated by the Director of Mass Spectrometry, Dr Giuliano Elia, and guided by the MSR Steering Group. To access and use the MSR instrumentation, interested users fill an Application Form and submit it in electronic format to the Director. When necessary, the different proposals received are prioritised by the MSR Steering Group. The MSR is financially administered under a running costs recovery model, with fees applied to the different workflows. The MSR has the use of the following instrumentation.

**Applied Biosystems 4700 Proteomics Analyzer**

A high performance MALDI-TOF/TOF (matrix-assisted laser desorption ionization tandem time-of-flight) mass spectrometer, which permits the detection of intact molecular ions as well as of fragment ions generated in a collision cell. The system is compatible with a variety of protein- and peptide-based workflows, including gel-based and liquid chromatography (LC) experiments.

GPS Explorer software allows sequence database searches based on masses of intact peptides generated by protein digestions, on fragment ion
The first Cervical Screening Research Consortium in Ireland, Cerviva, was officially launched in the Burlington Hotel, Dublin on 1 November 2006, with €1.25 million funding from the Health Research Board. The Cerviva consortium is a multi-investigator collaboration encompassing researchers at seven Irish universities, eight hospitals and ten commercial diagnostic/biotechnology companies. The purpose of the Consortium is to instigate and advance high quality peer-reviewed research programmes that provide the best possible information and guidance in the delivery of cervical screening services to women living in Ireland. Over the next five years we will conduct revolutionary research and find ways for all women to have access to the very best cervical screening procedures and the very best treatment opportunities. The consortium are fully committed to ensuring that all women living in Ireland understand that exposure to Human Papilloma Virus can cause cervical cancer and understand the benefit of receiving a vaccination against Human Papilloma Virus to prevent cervical cancer, in conjunction with

Thermo LTQ linear ion trap ESI MS

A linear ion trap mass spectrometer equipped with a nanoelectrospray ionization source. The LTQ is a state-of-the-art mass spectrometer with improved capacity, trapping efficiency, and scan speed. The LTQ can be set up to collect full scan MS and MSn data. Advanced scanning modes include data-dependent scans, zoom scans, and ultra zoom scans. Ion mapping experiments can be used to generate full scan, neutral loss, and parent ion maps. Both positive and negative ions can be detected.

The Thermo Fisher LTQ linear ion trap features:

- An extremely fast MS and MS/MS cycle time coupled to data-dependent acquisition.
- A good resolution in both MS and tandem MS (typically R>4000 @ 1000 m/z) which facilitates the determination of the charge state prior to database searching.
- A 200 to 4000 m/z mass range in normal operation. A typical mass accuracy of 150-500 ppm.
- A good sensitivity in MS mode and excellent sensitivity in tandem MS.

Thermo LTQ-FT linear ion trap ESI coupled to Fourier Transform Ion Cyclotron Resonance Detector

The LTQ-FT combines the most advanced Ion Trap and Fourier Transform Ion Cyclotron Resonance technologies into a single instrument with unprecedented analytical power and versatility. The instrument provides a high mass resolution, accurate mass determinations, and MSn for routine high-throughput analysis. Some highlights:

- Mass accuracy of better than 2 ppm with external calibration.
- Maximum resolution of better than 500,000 (FWHM @ m/z 400).
- Fast data acquisition rate (1 second) with very high mass resolution (100,000 at m/z 400) for unprecedented LC/MS performance.
- Sensitivity tests show that the LTQ-FT is capable of detecting peptides from a protein digest in the low attomole range.

Agilent 6510 Quadrupole Time-of-Flight LC/MS instrument

- Attomole-level sensitivity.
- Better than 2-ppm mass accuracy at MS level and 5-ppm mass accuracy at MS/MS level.
- 3-4 orders of magnitude in-spectrum dynamic range enabling identification of less-abundant compounds in the presence of more-abundant compounds.
- Fast MS and MS/MS spectral acquisition improving the identification of unresolved components in complex samples.

For additional information on the MSR, please visit the website [http://proteomics.ucd.ie/MSR/](http://proteomics.ucd.ie/MSR/) or contact Dr Giuliano Elia; E-mail: giuliano.elia@ucd.ie

Cerviva - the Irish Cervical Screening Research Consortium

Cara Martin & John O’Leary
TCD & The Coombe Women’s Hospital

The first Cervical Screening Research Consortium in Ireland, Cerviva, was officially launched in the Burlington Hotel, Dublin on 1 November 2006, with €1.25 million funding from the Health Research Board. The Cerviva consortium is a multi-investigator collaboration encompassing researchers at seven Irish universities, eight hospitals and ten commercial diagnostic/biotechnology companies. The purpose of the Consortium is to instigate and advance high quality peer-reviewed research programmes that provide the best possible information and guidance in the delivery of cervical screening services to women living in Ireland. Over the next five years we will conduct revolutionary research and find ways for all women to have access to the very best cervical screening procedures and the very best treatment opportunities. The consortium are fully committed to ensuring that all women living in Ireland understand that exposure to Human Papilloma Virus can cause cervical cancer and understand the benefit of receiving a vaccination against Human Papilloma Virus to prevent cervical cancer, in conjunction with
Tissue microarray (TMA) technology allows rapid visualisation of molecular targets in thousands of tissue specimens at a time, either at the DNA, RNA or protein level. TMAs allow for a high-throughput, simultaneous analysis of potential biomarkers in multiple tissue specimens (see Technology Update in DMMC News, March 2007). This technology allows for rapid validation of a new concept on actual human tissue and represents a mechanism for highly efficient use of this scarce resource.

Prof William Gallagher and co-workers organised an EMBO Practical Course on 'Tissue Microarrays and Image Analysis' from 11–15 June 2007 at the UCD Conway Institute. 18 attendees (representing 12 European countries) presented their work and were provided with hands-on experience in the experimental workflow from construction of TMAs to associated image analysis. The course comprised a combination of seminars from local and international experts in the field, including several ‘question and answer’ sessions, together with practical experience in the laboratory and on the computer. The five-day training programme provided the attendees with the opportunity to utilise leading-edge TMA construction and analysis facilities available at the UCD Conway Institute, together with the opportunity to learn from leading experts in the field.

The training was delivered by a group of expert researchers from the UCD Conway Institute, RCSI/Beaumont Hospital, Dublin City University, US National Cancer Institute, and Lund University. These included Prof Gallagher, Dr Stephen Hewitt, Dr Shauna Hegarty, Prof Caroline Kampf, Dr Karin Jirstrom, Prof Elaine Kay, Dr Amanda McCann, Dr Aaron Quigley, Dr Donal O’Shea, Dr Donal Brennan and Mr Tony O’Grady. Topics discussed included biomarker discovery and validation within the -omic era, application of TMA technology within basic research and clinical settings, mechanistic insights into drug resistance uncovered by use of TMA technology, use of advanced digital slide scanning technology for automated analysis of TMA data, and application of telepathology-based systems for fast-tracking analysis of TMA data.

During the first two days of the course, participants observed and participated in the construction and use of TMAs, with training provided in all relevant steps from tissue processing, array fabrication, sectioning, and immunohistochemical staining. Seminars were combined with wet-lab and computer-based practical sessions in TMA technology. The latter part of the course focused on analysis of immunohistochemical data, with emphasis on application of automated approaches and digital slide scanning of both full face sections and TMA slides. Data storage and use of online approaches for digital slide management, as well as image analysis using both manual and automated methods, and use of novel tools to support complex digital slide visualisation tasks were some of the topics discussed and also carried out in the computer lab.

Tutors were available to guide the participants through various image analysis algorithms - a mixture of commercially available and those developed in-house. The course allowed for the participants to analyse their own data. Finally, participants were introduced to a new walk-in cube-visualisation environment, developed by Dr Aaron Quigley (UCD School of Computer Science and Informatics). Prof Gallagher’s group has been working with Dr Quigley and his team in recent months to develop this prototype interactive environment for visualisation of histopathological/immunohistochemical data.

This EMBO Practical Course was the first of its kind organised worldwide in this subject area and it is hoped to be repeated next year. Further information can be obtained from william.gallagher@ucd.ie

Ruth Barrington appointed as CEO to DMMC

The Board of the DMMC is delighted to announce that Dr Ruth Barrington has been appointed as Chief Executive Officer of the company. Dr Barrington will take up the position on 1 October 2007, following the end of her contract...
with the Health Research Board, where she has been a very successful CEO for nine years.

Welcoming Dr Barrington’s appointment, Dr Michael Kamarck, Chairperson of DMMC, said: “Dr Ruth Barrington brings her substantial experience and track record to the DMMC at an exciting time for this major biomedical research collaboration between TCD, UCD and RCSI. University College, Cork, and National University of Ireland, Galway, are shortly to join the collaboration and the DMMC will become known as Molecular Medicine Ireland (MMI). MMI will align the activities of all five of Ireland’s premier biomedical research institutions and seven affiliated teaching hospitals. It will create a critical mass and centre of excellence in molecular medicine research and education”.

Commenting on the appointment, Dr Barrington said: “I am pleased to be taking up this important and challenging position, especially at this pivotal time in the translation of research into tangible benefits for improved health and economic progress in Ireland.”

ICRIN Coordinator

DMMC is pleased to announce the appointment of Margaret Cooney as Coordinator for the Irish Clinical Research Infrastructure Network (ICRIN). Margaret joins DMMC from Sanofi-Aventis Ireland Ltd, where she was Head of Clinical Operations, having previously worked for Allergan Ltd in the United States. Margaret has over 12 years experience in all areas of clinical development including management of Phase I-IV, interventional and non-interventional studies. Margaret is a graduate of, and holds a masters degree in Pharmacology from, University College Dublin.

ICRIN has been established by UCD, TCD, RCSI, NUIG, UCC and DMMC to promote coordination, spread quality standards, and provide Ireland with a network of harmonised competence centres to establish a world class clinical research capacity. The creation of ICRIN is a prelude to a large and ambitious project to create Molecular Medicine Ireland (MMI). ICRIN is supported by the Health Research Board and Health Service Executive.

See www.dmmc.ie for more information on these and other events
Please send details of forthcoming events to newsletter@dmmc.ie

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<tr>
<td>23 – 25 Jul</td>
<td>Course: Molecular Biology for Clinician Scientists&lt;br&gt;Further information from Regina Prenderville: 01 8032636</td>
<td>Fintan Gunne Lecture Theatre&lt;br&gt;48 Eccles Street, D7</td>
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<td>2 - 5 Sep</td>
<td>5th International Meeting on Rapid Responses to Steroid Hormones&lt;br&gt;<a href="http://steroid-rapid-responses.ucr.edu">http://steroid-rapid-responses.ucr.edu</a></td>
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<td>5 Sep</td>
<td>British Association for Lung Research Summer Meeting&lt;br&gt;More details at <a href="http://www.balr.org.uk/scientific.html">www.balr.org.uk/scientific.html</a></td>
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<td>12 - 14 Sep</td>
<td>SSM/IEA Joint Meeting&lt;br&gt;<a href="http://www.ucc.ie/academic/pubh/ssmiea/">http://www.ucc.ie/academic/pubh/ssmiea/</a></td>
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<td>13 -14 Sep</td>
<td>2007 Annual Meeting of the Irish Society for Immunology&lt;br&gt;www.irishimmunology.ie</td>
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<td>20 Sep</td>
<td>7th Annual UCD Conway Festival of Research&lt;br&gt;<a href="http://www.ucd.ie/conway">http://www.ucd.ie/conway</a></td>
<td>O’Reilly Hall, UCD</td>
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<td>1 – 2 Nov</td>
<td>Adolescent Cancer Conference&lt;br&gt;Contact Amanda at 01-4096720 or email <a href="mailto:Amanda.Kiely@olhsc.ie">Amanda.Kiely@olhsc.ie</a></td>
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