

Research Matters

Cúrsaí Taighde in Ollscoil na hÉireann, Gaillimh

SFI Funds Regenerative Medicine Institute (REMEDI) at NUI Galway

Science Foundation Ireland (SFI) has announced major funding for a new Centre for Science, Engineering and Technology (CSET) at NUI Galway. This is the second such CSET to be awarded to NUI Galway this year. The new Regenerative Medicine Institute (REMEDI) at NUI Galway will receive €15m from SFI over the next five years, with significant investments also being made by a number of multinational healthcare companies. Chief among these are Medtronic (Galway), ChondroGene (Toronto) and Charles River Biolabs Europe Ltd (Ballina).

Researchers in REMEDI will conduct basic and applied research in regenerative medicine. Regenerative medicine is an emerging field that approaches the repair or replacement of tissues and organs by incorporating the use of cells and genes to regenerate new healthy tissues. These approaches will allow for regeneration rather than replacement of diseased tissue in the future.

The central research platforms on which REMEDI will initially concentrate are gene therapy and adult stem cell research. Gene therapy is the correction or prevention of disease, through the addition of genetic material that corrects missing genetic functions or interferes with disease-causing processes. Adult stem cells have a remarkable ability to develop into many different cell types, and adult stem cell therapy presents new opportunities for the treatment of a broad spectrum of human diseases. The combination of these new

technologies will result in the development of a world-leading capability in regenerative medicine at NUI Galway.

The conceptualisation, preparation and submission of the proposal to SFI was the work of Professors Timothy O'Brien, Terry Smith (Director of the NCBES) and Dr Frank Barry. Professor O'Brien, a leading figure in gene therapy research, who was recruited from the prestigious Mayo Clinic in the US to the Chair of Medicine at NUI Galway in 2001, will direct REMEDI. Dr Barry, a stem cell researcher currently working in the US, will join REMEDI as Assistant Director. He brings world-recognised strength in adult stem cell technology to REMEDI and adds to the existing strength of Prof. O'Brien's research in gene therapy. The team is further enhanced by researchers in related areas of regenerative medicine in NUI Galway and partner institutions in Ireland. REMEDI will be located in the newly-built National Centre for Biomedical Engineering Science, which was funded by the Higher Education Authority's Programme for Research in Third Level Institutions, and is the only centre in the country that contains a modern facility for gene therapy research. The NCBES currently hosts over 100 researchers across Medicine, Science and Engineering and REMEDI will add a further 30.

In order to achieve its goal of bringing regenerative medicine to clinical application, REMEDI will work closely with key clinicians in University College



Hospital Galway (UCHG). The involvement of the healthcare industry sector will also be critical to the success of REMEDI. Galway is exceptionally well placed in this regard, being located at the centre of Europe's largest cluster of healthcare and medical device companies. Many of these companies already have well-established collaborations with researchers at NUI Galway.

REMEDI and its academic and industrial partners hope to play a key role in an area of research with immense potential for the development of new therapies for human diseases that are currently incurable. It also presents a unique opportunity for Ireland to be at the forefront of the development of regenerative medicine technology that is highly relevant to the future of the healthcare industry, a significant element of Ireland's economic development.

Dr Frank Barry; Professor Jim Browne, Registrar; Professor Tim O'Brien, Director of REMEDI; and Barry Dolan, Medtronic.

RESEARCH MATTERS

VOLUME 2

ISSUE 2

NOLLAIG, 2003

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Message from the Dean of Research

Fáilte chuig eagrán cinn bhliana de Chursai Taighde. As we approach year-end, Research Matters reports on several exciting research stories across the University.

The most recent announcement from Science Foundation Ireland, awarding €15m to the Regenerative Medicine Institute (REMEDI) (see cover story), is a massive boost to the University's research activity. This brings total research funding awards to almost €40 million for 2003. NUI Galway is the only university to have two SFI Centres for Science, Engineering and Technology (CSETs). Congratulations to Prof. Tim O'Brien, Dr Frank Barry and Prof. Terry Smith and everyone else who contributed to this outstanding success.

The recent announcement by the Minister for Education to "unpause" the capital funding for HEA/PRTL, is very welcome news; it allows the University to proceed with capital projects in Biomedical Engineering Science, Environmental Change, Marine Research and in the Centre for Innovation and Structural Change (CISC) (see page 3). The continuity of research activity is critical to our long-term goal of establishing Ireland as a location for world-class research.

The current edition of Research Matters has research news from all faculties, indeed the hallmark of many of the stories is the strong inter-faculty dimension that has traditionally been a significant feature of research in NUI Galway.

Nollaig Shona agus Athbhliain fé mhaise dár léitheoirí uile.

Christmas Greetings and a Happy New Year to all our readers.



Professor W.G. Hurley
Dean of Research

Research Matters is published by the Press & Information Office, in association with the Office of the Dean of Research. Items for publication, views, comments, and suggestions are all welcome.

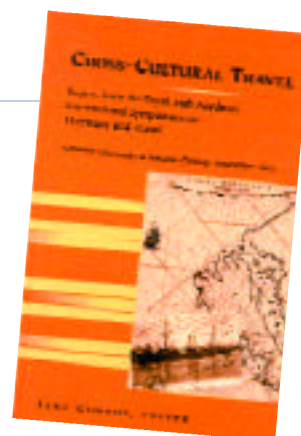
Please send these to: Máire Mhic Uidhir, Editor, (Press & Information Officer). Email: maire.mhicuidhir@nuigalway.ie

Travel across Time and Cultures

The proceedings of a major international conference on literature and travel held in November 2002 at NUI Galway, have been published.

The conference on the theme of Cross-Cultural Travel was held under the auspices of the Royal Irish Academy and its National Committee for the Study of Modern Languages chaired by Professor Catherine O'Brien, and with the support of the Centre for the Study of Human Settlement and

Historical Change. It was organised by Dr. Jane Conroy, French Department and Dr. Hermann Rasche, German Department. The proceedings of the conference is a 580-page volume which includes among its contributors such leading scholars as Joep Leerssen and Luigi Monga. Topics include testimonies of explorers, diplomats, journalists and artists, ranging from the sixteenth to the twenty-first centuries.



Online publication of environmental geochemistry data

The Internet Geographical Information System (GIS) techniques provide access to geo-referenced data in a user-friendly format on the Internet. They are widely applied in academic, business and government sectors. As a pilot study, the online publication of environmental geochemistry data of the Leinster

area is being investigated. Spatial interpolation and spatial analysis techniques are applied to produce maps with areas showing concentration levels of chemical elements in the environment. These methods provide a balance between data protection and data share for free access. Meanwhile, data quality is being evaluated by

comparisons between data produced by different laboratory methods. This is a joint research project between Dr. Chaosheng Zhang, Department of Geography and colleagues from the Geological Survey of Ireland (GSI).

Focus on

The Centre for Innovation and Structural Change (CISC)



The Centre for Innovation and Structural Change (CISC) was launched in March 2003, following the award of €2.8million in research funding under Cycle 3 of the Programme for Research in Third-Level Institutions (PRTL). The objective of CISC is to meet the analytical and policy challenges posed by change which emerges from knowledge-intensive innovation. A key motivating factor was a recognition that the greater rhetorical emphasis now placed in Ireland on developing the 'knowledge-based society' is often not matched by a commensurate capacity to understand, plan for, and evaluate rigorously, in this domain of public policy.

Research at CISC

The origins and consequences of innovation and technological change can be interrogated at many levels, and interpreted from different perspectives. Thus, CISC's research is interdisciplinary and its structure collaborative. The complexity of innovation and structural change motivates CISC's disciplinary openness and methodological diversity within the community of scholarship. Participants include economists, geographers and management scientists, as well as specialists in industrial relations, human resource management, and information systems. Thus CISC is grounded mainly in the disciplines of business and the social sciences, but is developing a capacity for research efforts involving multidisciplinary co-operation.

The core PRTL funding supports five postdoctoral researchers and up to 12 PhD students over the period to 2007. CISC's research is organised in five priority research areas:

- Systems of innovation
- Industry clustering
- Internationally traded services
- Inter-organisational systems
- High performance work systems

These range in perspective from essentially 'macro' analyses e.g. at the level of the nation-state, through to regional, industry and firm-level enquiries, involving a variety of approaches including survey work, analytical modelling, case studies and qualitative analyses.

In addition to the PRTL projects within these areas, CISC has been active in pursuing project funding from a variety of other sources. CISC is Ireland's representative in respect of two OECD projects, one related to the analysis of 'knowledge-intensive service activities', and another which is intended to improve the co-ordination of innovation-related policy at national levels. CISC also participates in a project led by CIMRU, funded by Enterprise Ireland, on human resource management information systems for small and medium enterprises.

An important part of CISC's brief is to interact with policy makers and the enterprise community at national and regional levels. From an early stage, CISC provided policy support to the Atlantic Technology Corridor which is an exciting initiative by firms in the area to highlight the developmental potential for clusters of high-tech firms along the western seaboard. CISC personnel have also undertaken policy work for the Western Development Commission, and are about to begin a three-year EU project in conjunction with the BMW regional assembly and five other partners in the EU on innovation at regional levels.

Apart from a range of occasional seminars, CISC has hosted a number of short conferences, including one on the European Consultation and Information Directive in March and the COLLECTeR (Europe) Conference on Electronic Commerce 2003 on eInnovation in June 2003. CISC will be hosting a conference of the EU Research and Technological Development Evaluation Network in May 2004. This conference coincides with the Irish presidency of the EU and is organised in co-operation with the Irish Council for Science, Technology and Innovation and Forfás. It is an example of how CISC has been able to build effective linkages across those communities engaged in science, engineering and technology and in related policy fields. Another example is CISC's involvement with the SFI-funded centre, DERI (Digital Enterprise Research Institute). CISC is supportive of DERI's education and outreach activity and has a research role in the area of complexity and eCommerce.

There is an open invitation from CISC to all members of academic staff to participate in its evolving programme of work. Some colleagues may find it of particular interest in providing a platform through which research funding opportunities under the EU 6th Framework Programme and the Irish Research Council for the Humanities and the Social Sciences may be pursued.

Photo: Dr. Aidan Kane, Director of CISC; Angela Sice, Project Manager and Prof. Roy Green, Dean, Faculty of Commerce.



Major funding awarded to support Digital Technology

The recently-established Digital Enterprise Research Institute (DERI) at NUI Galway, is to receive €2 million through the EU's Sixth Framework programme towards research on the application of Semantic Web Services.

The investment, over the next three years, will fund the Data, Information and Process Integration (DIP) project, the main focus of which is the integration of data, applications and digital processes within and between organisations.

DERI is the overall coordinator of the DIP project which comprises 19 partners located in many European countries including universities, research institutes, and major companies in the IT sector as well as small and medium-sized enterprises.

"The evolution of the networked economy means that integration efforts between organisations must increase significantly if the global economy is to benefit from and capitalise on the enormous opportunities presented by Semantic Web and Web Service technologies," says Professor Christoph Bussler, Executive Director of DERI.

Studies estimate that major parts of future IT budgets will be spent on integration activities within companies.

Essentially, computer technologies at present do not understand the meaning of the data and information that they exchange with each other in a Business-to-Business context. Semantic Web Services will change all that and this is what DERI, and the DIP project, is all about. The research aims to provide the machine-processable meaning of data and information, thereby enabling computers to query and manage semi-structured information.

DIP will apply the vision of Semantic Web Services to the integration issue thereby transforming it into a mature and scalable technology. "DIP aims to make Semantic Web Services a reality", says Professor Bussler. "It will provide an infrastructure which will revolutionise data and process integration in eWork and eCommerce in the same way as the Web did it for human information access."

Photo: Professor Christoph Bussler, Executive Director, DERI



Biosphere-Atmosphere Research at Mace Head

In September, the Atmospheric Research Station at Mace Head hosted an international collaborative research study into the exchange of aerosols and gases between the coastal biosphere and the atmosphere. The BIOFLUX (Biogenic Aerosol and Gas Flux Experiment in Coastal Hot-spots) international project was led by Dr Young Jun Yoon and Professor Colin O'Dowd, Atmospheric Science Research Group, Department of Physics and Environmental

Change Institute. The team also included groups from the US, Finland and Italy. The aims of the study were to further elucidate gas emissions from biogenic sources that have been implicated in ozone depletion and aerosol particle formation. The research was conducted from the Mace Head Research Station, the MRI Laboratory, Carna and from a research balloon and a mobile air quality laboratory.

Photo: Research Balloon at Mace Head

Super Nitrogen Structures

Research carried out in the Department of Chemistry under the direction of Professor R.N. Butler was recently highlighted in *Chemistry in Britain*, a monthly magazine for the chemistry community. Each month the magazine, published by the Royal Society of Chemistry, which has 55,000 members

worldwide, selects a number of landmark research papers. Professor Butler's research team, including Anthony Fox and John Stephens, investigated super nitrogen structures and succeeded in isolating the pentazole anion, a five-membered nitrogen ring and one of nitrogen's rare allotropes.

Sustainable Development through Wind Energy



The establishment of a Socio-Economic Research Cluster within the Environmental Change Institute (ECI) at NUI Galway has enabled social science research to contribute to the development of a fully interdisciplinary approach to environmental change. Research funding of €65,000 has been received by Dr. Suming Khoo to lead a project on The Political Economy of Development and Environmental Sustainability. There are two main pieces of research: one on environmental protest politics and one on the political economy of alternative and sustainable energy. The latter focuses on the policy regime driving the implementation of wind energy in Ireland.

Wind energy recently attracted much media attention due to the landslide in Derrybrien, Co Galway, where work on a windfarm had commenced. Dr. Khoo believes that environmental issues including wind energy and waste management are being debated in Ireland almost as single issues rather than in the broader environmental context with an emphasis on



sustainability. "One distinct finding across our projects so far", she says, "is that both political decision-makers and the wider public have relatively low levels of environmental knowledge. Shared responsibility for environmental issues

depends on better awareness and the translation of that awareness into action."

Dr Khoo's work assesses the social, political and economic context for the development of alternative and sustainable energy. Sustainability involves balancing the protection of the environment with the need for economic development.

Research has shown that Ireland has the best wind energy regime in Europe but the resource is at present underdeveloped. Dr. Khoo says that wind energy can help Ireland reduce levels of carbon dioxide emissions. "This is important as Ireland has already exceeded its emissions under the Kyoto Protocol and is liable to be fined as a result", she says.

According to Dr. Khoo, emphasis urgently needs to be shifted from brown, 'dirty' energy towards 'green' sources. "This will enable Ireland to move towards a more sustainable economy and lead rather than lag behind our European competitors."

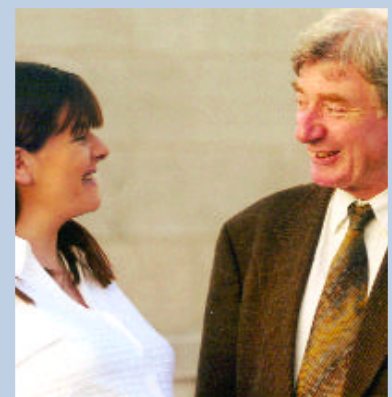
Pictured: Wind turbines

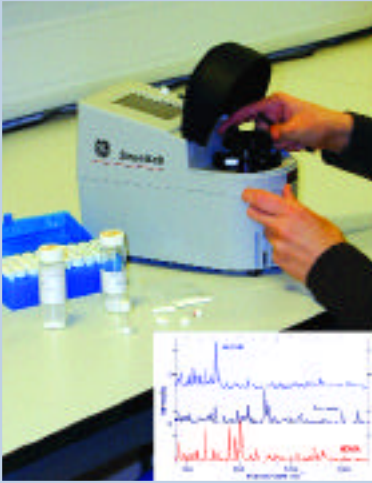
Scholarship saluted

Professor Nicholas Canny of the Department of History was the recent recipient of the Irish Historical Research Prize from the National University of Ireland for his book *Making Ireland British, 1580-1650* (Oxford University Press, 2001; paperback 2003). The prize is for the best piece of historical research by a graduate of the university published between 1 May 2001 and 30 April 2003. Dr. Catherine Stenson-Cox of the National Centre for Biomedical Engineering Science was awarded an NUI Postdoctoral Fellowship in the Sciences by the NUI. Through the establishment of a successful collaboration with a US-based company, Immunochemistry Inc., Dr. Stenson-

Cox leads one of only four groups to have access to a recently-developed tag for serine proteases, a family of enzymes that cleave proteins. This has led to the isolation of two novel serine protease activities that are associated with the onset of apoptosis, a form of cell death that contributes to many diseases, such as cancer. Dr. Stenson-Cox's research project will apply various techniques to identify the novel serine proteases and identify their functions in cellular destruction.

Pictured are Dr Catherine Stenson-Cox and Professor Nicholas Canny





Intelligent Analysis of Hazardous and Illicit Substances

A project aimed at developing new technologies for accurate, rapid identification and quantification of a range of materials, including illegal narcotics, explosives and medicines, has been undertaken by Dr Michael Madden of the Department of Information Technology and Dr Alan Ryder of the National Centre for Biomedical Engineering Science.

Drs. Madden and Ryder have been awarded two research grants totalling €460,000 from Enterprise Ireland for a three-year project. The research will be conducted by combining Raman Spectroscopy, which is a laser-based technique for 'chemical fingerprinting' of materials, with Machine Learning, which is a family of techniques used to disentangle these fingerprints to identify the constituents of a substance and estimate its concentrations.

The results of this research may be applied to practical situations in everyday life. The scientists hope to develop a 'lab in a box,' which can be used without special training in diverse areas such as accident and emergency departments and airport security.

If, for example, drugs or explosives are detected in an airport, they can be tested on the spot using this new method. This will yield faster results than would be obtained by sending the substances to a laboratory. Likewise, an illness caused by various materials

including narcotics or poisonous substances can be diagnosed in rapid time.

"The project is about the molecular fingerprint of a drug," explains Dr Ryder. "You are looking at the molecular structure of drugs and getting the distinct pattern of the substance, through the Raman system." The 'lab in a box' equipment is the size of a few books and can test bulk samples of a variety of materials, including drugs, explosives and hazardous industrial chemicals.

"We learn by examining specific examples of a substance," says Dr. Madden. "In this project, we want to identify specific examples of hazardous and illicit substances. We use Machine Learning to recognise different categories of drugs. The data is collected and can be analysed quicker than ever before".

"This sophisticated method of intelligence-gathering is not available at present," says Dr. Madden. The data will be collected using a portable device. "We want to create an all-inclusive database so that we can come up with rapid results," he says.

The project has just commenced and the researchers are confident that within the three-year time-frame, they will produce a system that will revolutionise the rapid detection of illicit and hazardous materials.

Photo: Streetlab and the Raman spectra of 3 narcotics

German Foundation funding International research

Dr. Anthony Moran, Department of Microbiology, was recently awarded a prestigious Senior Fellowship by the Alexander von Humboldt Foundation (Bonn, Germany). The award was made in respect of his studies on bacterial toxins and his work in microbial glycobiochemistry with gastrointestinal bacteria. This foundation supports eminent

foreign scientists and scholars to undertake research at German academic and research institutions. Dr. Moran's fellowship was spent in the group of Professor Ernst Rietschel at Schleswig-Holstein, which has attracted worldwide attention for studies on sepsis (blood poisoning), meningitis and septic shock.

Towards improving financial management

As part of the Royal Irish Academy Third Sector Research Programme, a Postgraduate Award has been presented to Colette Reynolds of the Centre for Health Promotion Studies. Her PhD, entitled 'Evaluation of the JOBS programme: depression prevention in Ireland,' is being supervised by Dr. Margaret Barry through the Department of Health Promotion.

The research is concerned with an innovative programme called the JOBS programme, which is a

community-based initiative involving a diverse range of voluntary and state agencies operating on a cross-border basis. The overall objective of the research is to systematically evaluate a preventative intervention aimed at providing job-seeking skills to promote re-employment and to combat feelings of depression among the unemployed. As such, it fits in with the aims of the Royal Irish Academy to develop knowledge, ideas and theories that will be of use to voluntary and community agencies and the sector as a whole.

NUI Galway Scientists complete first Irish Deep-Sea Survey



Recently staff and student members of three departments within the Science faculty took part in the first entirely Irish deep-sea survey on an Irish research vessel. The work was undertaken within the context of the university's PRTL Cycle 3 marine programme, funded by the HEA. It was the first of four scheduled surveys to be completed in the next two years of the marine programme utilising Ireland's new state of the art research vessel, Celtic Explorer.

The purpose of the twelve-day survey, led by Dr. Martin White of the new Department of Earth and Ocean Sciences, was a multidisciplinary study of the physics, chemistry and biology of the deep water west of Ireland. The area under investigation ranged from 51-54°N and out to 17°W, some 250m west of Ireland. The zoobenthos group of the Zoology department (led by Dr. Robert Kennedy and Dr. Gerd Koennecker), took numerous soft seafloor samples to assess the biodiversity of the fauna across a range of ocean depths (200-3000m).

Traditional grab and core-sampling methods were supplemented by the use of the Sediment Profile Imagery (SPI) system, which takes pictures of the seabed surface as well as vertical profiles within the seafloor. Results will provide valuable information on the depth zonation and health of the seabed communities and the result of natural and



anthropogenic impacts on such ecosystems. This coupling of traditional sampling with digital imaging of the deep ocean floor represents a 'first' for the waters off the Irish west coast.

Furthermore, samples of the bacterial community that inhabits the deep waters (greater than 1000m) of the southern Rockall Trough were also sampled by members of the Microbiology department, led by Dr. John Patching. This work investigates the bacterial community structure and its response to natural or anthropogenic organic carbon inputs to the deep ocean.

Deployment of instruments to measure deep ocean

currents and the water masses were also undertaken during the course of the survey. These will provide information on the deep-water movements that form a significant part of the ocean-atmosphere system controlling the earth's climate.

The physical measurements included the launching of the two sub surface floats to measure the deep currents and the temperature and salinity conditions for up to two years. The deployments constitute Ireland's first contribution to a major international collaborative programme which hopes to seed the world's ocean with up to 3000 floats to measure deep currents.

Personnel taking part in the survey include five from the Dept of Earth and Ocean Sciences, seven from the Department of Zoology's Benthos Research Group, three from Microbiology and one from the local Galway consultancy company, Aquafact International Services Ltd.

Pictured: NUI Galway scientists on board the Celtic Explorer

NUI Galway Professor Elected to Leading Scientific Organisation

Professor Noel Lowndes of NUI Galway's Department of Biochemistry has become a member of the European Molecular Biology Organisation (EMBO). He is just one of three Irish-based scientists elected to the prestigious organisation which includes 36 Nobel Prize laureates among its members.

Professor Lowndes, who has established an international reputation in cellular responses to DNA damage, leads Ireland's first Genome Stability Cluster at NUI Galway. His research

team is studying how normal cells respond when the genetic material is damaged and how defects in these responses result in cancer. DNA damage is caused by diverse agents ranging from sunlight and cigarette smoke to ionising radiation from either natural sources or from nuclear power plants.

Pictured are Professor Noel Lowndes (standing) with Dr. Ian Dobbie of the Genome Stability Laboratory.



The James Hardiman Library in support of Research

It is not unusual for researchers to travel far afield and spend long hours in distant libraries to support essential primary research. However, thanks to the electronic revolution in libraries, today's researchers at NUI Galway are no longer geographically disadvantaged in terms of scholarly access, and hopefully will need to do less travelling. "Last year the Library spent €427,000 - almost one quarter of its acquisitions budget - on subscriptions to electronic resources, primarily in support of research," according to Librarian Marie Reddan. From the desktop, any researcher has access to over 10,000 journal titles in full text, many with complete backruns - a considerable improvement on more modest holdings of 2000+ print titles of a few years ago. Every faculty benefits from the investment and in addition to the recurrent library budget, generous funding from individual faculties or departments has enabled the acquisition of some superb resources. These include Early English Books Online (EEBO) which offers full-text facsimiles of over 125,000 titles printed in English between 1475-1700 and the recently acquired Times Digital Archive from 1785-1985. It is worth noting also that the James Hardiman Library was the first Irish university library to acquire these. Engineering researchers make full use of Ei Village and IEEE online. LexisNexis contains the full text of 3,800 world newspapers; business research is richly supported by Business Source Premier; and for Science, Elsevier's Science Direct is a must. The list could go on and on.

However, not all of our treasures are electronic. More recent major archival acquisitions have considerably enhanced Galway's reputation as research destination of choice - a prime example here being the John McGahern archive. Rich resources in Irish theatre archives are also unique to Galway.

But research support involves more than provision of resources, and in the Library much emphasis is placed on personal contact with researchers through the team of professional librarians who liaise with Faculties. They work to promote the resources, heighten awareness of their content through seminars and workshops, and also promote the Library's small but useful financial contribution to individual researchers - the Library's Special Research Fund. Feedback too is essential, and a recent major survey of our research community has provided excellent information to guide our future direction.

Still there is no time for complacency. As Galway's success in winning research funding increases, so does the specialist nature of support material required, and budgets are finite. "Meanwhile," says Marie Reddan "it should be of some comfort to our researchers who look at the Library websites of Harvard and Yale, to see many familiar resources to which they also have access through NUI Galway's own virtual library."

Affirmative action to encourage political participation of women

Dr. Eilis Ward of the Women's Studies Centre, NUI Galway, was the editor and co-contributor to a British Council-funded research project on women and affirmative action in parliamentary politics in East Africa, which was conducted in the Summer of 2003. Entitled "Political Space: the experience of affirmative action in Eritrea, Tanzania and Uganda", the study found that the use of quotas in the three East African states has transformed women's profile in the political realm. It has offered women opportunities that otherwise would have been denied them and has created dynamic role models for future leaders.

University partners in the research were the Centre for Advancement of Women in Politics, Queen's University, Belfast, where Dr. Ward is a research associate, and the Department of Gender and Women's Studies, Makerere University, Uganda. Nearer home, a UN report earlier this year concluded that Ireland has the lowest percentage of women (at 14 per cent) in national parliaments in Europe, and is very far off the UN target of 30 percent. As the Seanad is in the process of being reformed and restructured, Dr Ward and her colleague Dr Yvonne Galligan have made a submission to redress the lack of gender equality in the upper house.

