REMEDI’s vision is to develop a new and realisable paradigm for medicine in the future utilising minimally invasive therapeutic approaches to promote organ and tissue repair and regeneration thus avoiding the need for replacement.
A Message from the Director

The Regenerative Medicine Institute was established at NUI Galway and partner academic institutions in 2004 with funding obtained from Science Foundation Ireland.

REMEDi’s vision is to develop a new and realisable paradigm for medicine in the future utilizing minimally invasive therapeutic approaches to promote organ and tissue repair and regeneration thus avoiding the need for replacement. To achieve this, the REMEDI translational research programme has a mission to conduct basic research in fundamental stem cell biology and to translate and commercialize research outputs by developing regenerative medicine therapies for diseases such as cardiovascular disease, diabetes mellitus and osteoarthritis. Supporting the realization of our vision are the strategic partnerships REMEDI has forged with the ‘academic, the health service and industry.

As REMEDI enters the second, exciting phase of its development following renewed funding from Science Foundation Ireland, its focus will shift to translating the basic research findings from the initial exploratory phase of REMEDI to clinical trial applications – to effectively progress from research to human therapy. This new phase in the existence of REMEDI will allow Irish patients access to novel therapies through state-of-the-art clinical trials and research. It will also allow REMEDI to build on its existing partnerships with Irish companies operating in the medical technology area, to further develop a global hub of medical device technology in Ireland.

In addition to SFI funding, REMEDI enters its second phase with some additional significant and complementary developments which will greatly enhance regenerative medicine research in Galway, including:

- A new Bioscience Research Building on the University campus and a new Translational Research Facility on the grounds of Galway University Hospital. Both developments are funded by the Higher Education Authority’s PRTLI programme and will enable the co-location of researchers from cognate disciplines in regenerative medicine.
- An extension of the existing industry partnership with Medtronic and the establishment of new partnerships with indigenous SME companies; Creganna-Tactx Medical, Procure, Ovagen, Proxy Biomedical, Ziel Biopharma and EnBIO.
- A partnership between Galway University Hospital and NUI Galway to prioritise the development of translational regenerative medicine.
- New Graduate Research Education Programmes in Biomedical Engineering and Regenerative Medicine, Translational Medicine, Molecular and Cell Biology and Simulation Science, funded by PRTLI.
- Additional REMEDI successes in securing EU FP7 research funding for a range of projects, including GAMBA, ADIPOA and EuroStemCell.
- An extension of REMEDI’s academic partnerships to include the Centre for Vascular Biology Research at University College Cork and the Singapore Stem Cell Consortium.

The goal of the Regenerative Medicine Institute is to conduct basic research in stem cell biology, translating the outputs to clinical products, and to rapidly commercialize its technologies. We appreciate the confidence and belief placed in REMEDI as evidenced by the initiatives and funding described herein. We are conscious of the current challenging economic environment in which we work and the responsibility to ensure that state money awarded to REMEDI is used in such a manner to return maximal benefit to the citizens of Ireland, including both economic and health benefits. We look forward to actively working towards these goals with our partners in academia, industry and the health service in the years ahead.

The Regenerative Medicine Institute at NUI Galway

Regenerative Medicine is an evolving and exciting area of medical science, which aims to regenerate tissue thus avoiding the need for organ replacement and the associated problems with sourcing of donor organs.

Developments in the field hold enormous potential for the treatment of currently untreatable degenerative diseases. Essential disciplines that provide the scientific foundation of Regenerative Medicine include stem cell biology, gene therapy, medical device technology, biomaterials science, chromosome biology, glycobiology, developmental biology, immunology, vascular biology, orthobiologics and clinical science. As component units of a multidisciplinary collaborative group, REMEDI has assembled faculty in these disciplines at NUI Galway and partner institutions, with the aim of harnessing knowledge of basic stem cell biology to generate new regenerative therapies.

One of REMEDI’s priorities is to train the next generation of physicians and scientists in the area of regenerative medicine. Our learning environment provides students with an opportunity to see research translated into real life applications.

Our students not only benefit from REMEDI’s cross-disciplinary and interactive environment, they are also mentored by internationally recognised academic staff, all of whom bring their experience of applied research into the lecture theatre.

We have developed a number of postgraduate programmes including a structured graduate research education programme in Biomedical Engineering and Regenerative Medicine and a taught MSc in Regenerative Medicine, which is the only one of its kind in Ireland, and one of only a few such programmes worldwide. Other educational innovations include a Special Study Option for undergraduate medical students in regenerative medicine.

REMEDI will also play a central role in four graduate research education programmes to be funded by the HEA, generating a cadre of basic, clinical and translational researchers for the future. Through their participation in a structured PhD programme having close industry collaborations, these graduates will engage in cutting edge research in addition to gaining valuable transferable skills.
INDUSTRY
Strong partnerships with industry have always been key to REMEDI’s success and as the Institute enters its second phase, those partnerships have been enhanced and expanded.

REMEDI’s successful collaborative relationship with Medtronic has been extended for the next five years and will expand to include additional disease areas.

REMedi has also entered into five new partnerships, which will enhance the potential for commercialisation of our research outputs.

We would like to acknowledge the extensive engagement of our industry partners and look forward to working closely with them to further embed research and innovation within their activities. REMEDI will interact with government agencies, industry partners, academic institutions and the health service to further develop a global hub of medical device technology.

HEALTH SERVICE
The translation of basic research in stem cell biology to clinical regenerative therapeutics will require close interaction between REMEDI and the health service. NUI Galway and Galway University Hospital (GUH) have agreed to work together to promote a strategic approach to developing regenerative medicine within our region. In recent years NUI Galway and GUH have recruited translational clinician scientists and have committed to continue this process into the future. In addition, the involvement of REMEDI with the Irish Clinical Research Infrastructure Network will facilitate the realisation of a national approach to translational regenerative medicine.

ACADEMIC PARTNERSHIPS
REMEDI is determined to ensure that the best talent available on the island of Ireland is harnessed in an optimal manner to ensure successful translation in Regenerative Medicine. We have forged additional partnerships with the Centre for Research in Vascular Biology at University College Cork (UCC) and the Centre for Vision Science at Queen’s University Belfast (QUB). The interaction with UCC will focus on regenerative approaches to treat myocardial infarction, while that with QUB will focus on the use of stem cells to prevent blindness associated with diabetes mellitus. In addition, we have extended the scope of our international partnerships through new collaborations with the Singapore Stem Cell Consortium and the Wake Forest Institute for Regenerative Medicine.

RESEARCH FUNDING
REMEDI has secured additional research funding from the European Union. In addition to the coordinator role REMEDI plays in PurStem, additional funding successes have been gained through programmes such as the ADiPOA consortium (Adipose derived stromal cells for Osteoarthritis) and GAMBA (Gene Activated Matrices for Bone and cartilage regeneration in Arthritis) and EuroStemCell. REMEDI will continue its efforts to ensure that state funding is used to leverage additional non-exchequer funding in order to support our research programmes.
Research programmes
STEM CELL BIOLOGY

The interest in stem cell therapies has grown exponentially over the last decade as their tremendous potential to lead to effective treatments for a variety of major diseases is being realized. Despite many breakthroughs, stem cell therapy is still largely experimental and the development of a worldwide platform in cell-based regenerative medicine is hindered by a number of factors such as the slow pace of clinical development, limited manufacturing capacity, a need for further research to address efficacy, mode of action and the development of a framework of quality systems and compliance.

The objective of REMEDI’s research programmes in stem cell biology is to enhance our understanding of the biological regulation of adult stem cells, to validate selected cell-based therapies in pivotal preclinical studies, to develop new testing systems for release of cellular products in a regulated environment and to establish GMP-compliant manufacturing systems. These topics are addressed in a series of projects that have as their objective a greater understanding of how stem cells behave in their natural environment and how the cells interact with the injured host in the context of tissue repair. In addition to the therapeutic use of stem cells for selected disease targets, REMEDI has also developed a programme to explore the potential opportunities associated with induced pluripotent stem (iPS) cells. The ability to reprogramme somatic cells lends exciting opportunities in the exploration into the mechanisms of disease. In the first instance, the focus of the REMEDI iPS programme will be to explore cellular mechanisms in arthritic disease.

GENE THERAPY

The central hypothesis of this work programme is that the efficacy of allogeneic or autologous MSC (mesenchymal stem cells) or EPC (endothelial progenitor cells) transplantation for the treatment of myocardial infarction (MI), osteoarthritis (OA) or peripheral vascular disease (PVD) can be improved by genetic modification of the cells. REMEDI is developing gene delivery methods to support the development of these next generation cell-based therapeutics. Our research effort concentrates on two systems: non-viral vectors, which have a relatively positive biosafety profile although they currently lack efficiency and long-lived transgene expression; and adenoviral vectors, which are highly efficient but result in short-lived gene expression with unknown immunological consequences in the context of MSC modification.

We are designing a synthetic vector system for specific transfection of MSCs or EPCs through focused optimization of 1) lipoplex structure (DNA/lipid complexes), 2) REMEDI’s proprietary antibodies for specific targeting of MSCs or EPCs and 3) peptides for nuclear localization, endosomal release and cytoplasmic transport to further improve transfection efficiencies. Furthermore, the immunological aspects of gene-modified MSCs transduced with first- or third-generation (helper-dependent) adenoviral vectors having reduced immunogenicity is being examined.

The unique ability of MSCs to express immunosuppressive molecules may prevent immune activation and rejection after adenovirus-mediated gene transfer or genetic modification by synthetic vectors.

IMMUNOLOGY

The future success of stem cell therapies is intimately linked to the interaction of these cells with the immune system of the individual patient receiving treatment. We now know that one of the most important beneficial actions of mesenchymal stem cells (MSC) and other stem cells is to suppress and modify potentially harmful inflammation and immune activity in the body. Despite this, there is also evidence that like solid organ transplants, MSCs from a healthy donor may be rejected by the recipients’ immune system in a process termed the allogeneic immune response.

The REMEDI Immunology Group comprises Prof. Matthew Griffin, Prof. Rod Ceredig and Dr. Thomas Ritter at NUI Galway and Dr. Bernard Mahon at NUI Maynooth. Working in collaboration with the REMEDI programmes in Basic Stem Cell Biology, Cardiovascular Disease and Orthobiologics, they are leading a cadre of PhD students and Post-doctoral Researchers toward a better understanding of the MSC/immune system interaction with particular focus on: (a) Overcoming the allogeneic immune response to “off-the-shelf” MSC therapies from healthy donors, (b) Developing new strategies to improve the immune suppressive effects of MSC in cardiovascular and orthopaedic disease states, (c) Measuring the immune potency of therapeutic MSC and (d) Discovering novel molecular mechanisms underlying MSC modulation of immune cells.
Peripheral Vascular Disease

Peripheral vascular disease (PVD) manifests as intermittent claudication or critical limb ischemia and is a major global health problem affecting 3-10% of the population. This disease burden is likely to consume increasing health care costs due to increased prevalence of risk factors such as obesity, diabetes mellitus and an ageing population. The treatment of choice for critical limb ischemia is restoration of blood supply via surgical bypass or angioplasty. A significant proportion of PVD patients are unfortunately not suitable for revascularization and amputation is frequently required for these ‘no option’ patients. New approaches to this debilitating condition are urgently required, working collaboratively with its industry, academic and clinical partners.

REMEDI is developing new therapies to regenerate blood vessels in the legs of these patients.

Wound Healing

Diabetic foot ulcers are a major cause of morbidity and mortality in current clinical practice. While the worldwide prevalence of this condition has been documented, data from the Diabetes Federation of Ireland reveals that 1,579 people with diabetes mellitus underwent below knee amputation in Ireland during the years 2005 to 2009, with an additional 6,000 patients required inpatient treatment for a lower extremity ulcer. The estimated cost of this health care delivered was €239 million.

New treatments to enhance diabetic wound healing are urgently required to lower the risk of amputation and to decrease the length of patient hospital stay. A variety of stem cell types have been shown to enhance wound healing in preclinical models of diabetes mellitus. REMEDI is working on the development of regenerative strategies to enhance wound healing in diabetes mellitus. This work will also be of relevance to other problems with wound healing such as burns and epidermolysis bullosa.

OSTEOPOROSIS

Osteoarthritis (OA) is a complex condition with broad pathology, featuring damage and loss of articular cartilage as a consistent feature. While the onset of OA may be a slow and progressive process being clinically “silent” for many years, trauma such as meniscal or ligament damage are predisposing factors. We have shown that delivery of mesenchymal stem cells into an injured joint effectively slows down the development of OA, these cells remain at the forefront of current translational in cellular therapy for a broad spectrum of diseases including osteoarthritis.

Within the REMEDI Orthobiologics Group, Udo Greiser, Cynthia Coleman, Eric Farrell and Prof. Abhay Pandit are working with Prof. Frank Barry and Dr. Mary Murphy to investigate the mechanisms whereby stem cells can prevent development of OA and how these cells can be used to repair damaged, osteoarthritic cartilage or to promote integration of metal implants currently used for joint replacement. A close interaction with clinical collaborators from the Orthopaedic surgical unit at Galway University Hospital, Messrs. William Curtin, Fintan Shannon and Stephen Kearns, will ensure our translational aims are achieved. Also critical to the successful implementation of the project is a close working relationship with our Industry Partners. These include local Galway companies, Creganna-Tactx and Proxy Biomaterials, EnBIO based in Cork and Ovagen a SME recently set up in Ballina, Co. Mayo.

Translational Targets

Peripheral vascular disease (PVD) manifests as intermittent claudication or critical limb ischemia and is a major global health problem affecting 3-10% of the population. In the US alone, it is estimated that 8-12 million people suffer from limb ischemia and the PVD market is estimated to be worth in the region of $4 billion per annum. This disease burden is likely to consume increasing health care costs due to increased prevalence of risk factors such as obesity, diabetes mellitus and an ageing population. The treatment of choice for critical limb ischemia is restoration of blood supply via surgical bypass or angioplasty. A significant proportion of PVD patients are unfortunately not suitable for revascularization and amputation is frequently required for these ‘no option’ patients. New approaches to this debilitating condition are urgently required, working collaboratively with its industry, academic and clinical partners.

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Heart failure is assuming pandemic proportions in the setting of an ageing population with many of these patients developing heart failure due to myocardial infarction (heart attacks). REMEDI aims to develop regenerative approaches to reduce the amount of heart muscle lost after myocardial infarction and thus lower the risk of heart failure. This work is being lead by Prof. Noel Caplice from University College Cork and will involve interaction with industry partners to develop regenerative therapies for administration after myocardial infarction. This body of research includes the determination of optimal stem cell type, dose regime, and timing of administration. Researchers are also focusing on medical device development.
Principal Investigator

Profiles
Dr. Mary Murphy

Dr. Mary Murphy is a Lecturer in Regenerative Medicine at NUI Galway. She completed both undergraduate and postgraduate studies at University College Cork and worked as a researcher in both academia and the biotechnology sector in the US before joining REMEDI in 2004. Dr. Murphy’s interests focus on the biology, mechanism of action and the use of adult stem cells for tissue regeneration in the orthopaedic area, with particular emphasis on osteoarthritis. Building on previous work, the REMEDI orthopaedic group will continue to promote the translation of basic research on the role and use of stem cells in bone and articular cartilage repair to clinical practice.

Prof. Rhodri Ceredig

Prof. Rhodri Ceredig is SFI Stokes Professor of Immunology. His research interests focus on how hematopoietic stem cells undergo differentiation to become lymphocytes, knowledge applicable in understanding the mechanisms of mesenchymal cell differentiation. Graduating in Medicine in 1974, in 1980 he obtained a PhD in immunology from Melbourne University. From 1980-85 at the LICR, Lausanne he was the first to combine flow cytometric sorting with limiting dilution analysis to quantify immune responses in vitro. With Prof. Peter Doherty, Nobel Laureate at the JCSMR, Australian National University, Prof. Ceredig used flow cytometry to dissect inflammatory reactions in vivo. At the Université Louis Pasteur, Strasbourg he developed a transgenic mouse over-expressing the cytokine Interleukin-7. In 1994, he became an INSERM scientist and from 1996-1998 was a member of the Basel Institute for Immunology. He has published 118 peer-reviewed journal articles, 8 conference papers and 10 book chapters.
Dr Thomas Ritter was recruited by NUI Galway as a Lecturer in Medicine at the Regenerative Medicine Institute in 2005. Dr. Ritter has over 14 years of experience in the field of gene therapy and immunology in transplantation. He obtained his PhD in 1994 at the University of Erlangen-Nuremberg, Germany. Having completed his Post-Doctoral Fellowship in Immunology in Marseille, France in 1995, Dr. Ritter took up a faculty position at the Charité-University Hospital in Berlin, Germany. Dr. Ritter completed his postdoctoral lecture qualification in Immunology in 2002. Recently Dr. Ritter has attracted significant funding from both Science Foundation Ireland and the Health Research Board.

Prof. Matt Griffin is Professor of Transplant Biology at NUI Galway and a Consultant Nephrologist at Galway University Hospitals. His interests lie in the immunological mechanisms underlying kidney disease and organ transplant complications, as well as the role of stem cell therapies in suppressing harmful immune responses. Within the REMEDI Immunology group, his laboratory examines how insights gained from the field of organ transplantation can be applied to achieve better success with ‘off-the-shell’ stem cell therapies. Prof. Griffin qualified in Medicine from UCC in 1988 and has trained and worked in Nephrology, Transplantation and Experimental Immunology in the University of Chicago and Mayo Clinic in the United States before joining the REMEDI faculty in 2008.

Prof. Noel Caplice received his medical degree from University College Cork in 1986. After internship, medical residency and early cardiology training at the Cork University Hospital he completed a PhD in Cell and Vascular Biology at the University of Queensland, Australia (1992-1994) and a fellowship in clinical cardiology at the Prince Charles Hospital, Brisbane, Australia. He subsequently completed a post-doctoral fellowship in Molecular Biology and an interventional cardiology fellowship at the Mayo Clinic, Rochester, MN, USA.

In 2005 he took up appointment as the Professor of Cardiovascular Sciences at UCC and consultant physician/cardiologist at Cork University Hospital. He currently directs the Centre for Research in Vascular Biology (CRVB) at UCC and his research programme is funded by the National Institutes of Health (NIH), SFI-PI grant, and Health Research Board (HRB) - Translational research.

Dr. Faisal Sharif has been appointed Senior Lecturer in Regenerative Medicine at NUI Galway and Consultant Cardiologist at Galway University Hospital. In addition to his research role at REMEDI, he is a consultant interventional cardiologist at Galway University Hospital. During his clinical training as a specialist registrar in cardiology, he received his PhD from NUI Galway in 2007 for research into strategies to prevent stent failure using gene therapy approaches following vascular interventions such as stent deployment. His research aims to improve the long-term outcome of vascular interventions and reduce the need for antiplatelet therapy and its attendant risks. Moreover, whilst completing successful cardiology fellowships in both France and Belgium, Dr. Sharif continued his research interest in this area in collaboration with REMEDI as part of the lipostent project funded by Enterprise Ireland.
Dr. Alan Colman is currently Principal Investigator in the A*STAR Institute of Medical Biology, Executive Director of the Singapore Stem Cell Consortium and Adjunct Professor of Fundamental Stem Cell Biology at NUI Galway. A graduate of Oxford University with a degree in Biochemistry, Colman earned a PhD under John Gurdon, a pioneer of the field of nuclear transfer at the MRC Laboratory of Molecular Biology in Cambridge, UK. Dr Colman held a series of academic appointments in Oxford and Warwick Universities before becoming a Professor of Biochemistry in the University of Birmingham.

The focus of his academic career was the area of eukaryotic protein secretion, with a particular emphasis on the use of frog oocytes and eggs as in vivo test tubes. In 1987 he was elected as a member of the European Molecular Biology Organisation. From 1987 until March 2002, he was research director of the company PPL Therapeutics in Edinburgh, UK. This company specialized in the production of transgenic livestock that produced human therapeutic proteins in their milk. PPL attracted considerable media attention because of its participation, together with the Roslin Institute, in the technique of somatic nuclear transfer. This work led to Dolly, the world’s first sheep cloned from an adult somatic cell in 1996.

Dr. Bernard Mahon is a senior Immunologist based in the Institute of Immunology at NUI Maynooth. His expertise is in understanding how cell therapeutics interact with the recipient immune system. He studied under Ivan Roitt, before working in NIBSC, the regulatory agency for Immunological products in the UK. On completing his PhD, he accepted a Wellcome Trust-funded post doctoral position in NUI Maynooth, and was later awarded a Wellcome Trust/HRB “new blood” fellowship to study mucosal immunity. He has been the scientific director of his Institute and also served as Dean of Science in Maynooth. In 2009, he was recognised with the Servier scholarship for collaborative work with the Institut Pasteur de Lille. He has published over 50 papers advancing understanding of Immunology and has provided expert opinion to Irish and US industries regarding cell therapies and manufacturing processes.
The NUI Galway policy of targeted recruitment in priority research areas has resulted in the development of a number of research programmes relevant to the fundamental stem cell biology and translational arms of REMEDI. The collaboration between stem cell biology, developmental biology, cancer biology and glycoscience is particularly relevant. The translational programme includes interaction with biomaterials and medical device technology programmes. Brief profiles of a selection of the relevant researchers and programmes are described here:

DEVELOPMENTAL BIOLOGY
Dr. Uri Frank
Dr. Uri Frank and his team at the Department of Zoology at NUI Galway collaborate with REMEDI researchers in studying how manipulation of key stem cell genes affects stem cells and their derivatives. In particular, Frank’s group and REMEDI researchers are attempting to establish flow cytometry as a method for quantitative analysis of cell composition of whole animals.

CENTRE FOR CHROMOSOME BIOLOGY
Prof. Noel Lowndes
The Centre for Chromosome Biology (CCB www.chromosome.ie) is an interactive and dynamic research environment focused on the biological significance and medical applications of chromosome structure and dynamics. The CCB is currently composed of 11 Principle Investigator-led groups, all at NUI Galway, drawn from the Disciplines of Biochemistry and Plant Science, as well as REMEDI and the NCBES.

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GLYCOSCIENCE
Prof. Lokesh Joshi
The Alimentary Glycoscience Research Cluster (AGRC) is an inter-institutional, multi-disciplinary consortium of academic, clinical and industrial researchers funded by Science Foundation Ireland (SFI), which is exploring the role of gut glycosylation in host-microbe interactions. AGRC is also developing innovative, high-throughput analytical platforms for glycan analysis, developing mimics and analogues of glycans and the corresponding lectins involved in these interactions. This coordinated effort will build technological capacity and commercial opportunities in an area of high scientific and commercial potential, particularly in the biopharmaceutical, biomarker, bioanalytical, dairy and food sectors. The technology is currently being applied to develop an understanding of stem cell glycomics.

NETWORK OF EXCELLENCE FOR FUNCTIONAL BIOMATERIALS
Prof. Abhay Pandit
The NFB work programme focuses on the design and development of a biomaterials platform technology, which is functionalised and optimised through a combinatorial design approach. The NFB research programme hosts several patented technology platforms associated with the development of implantable materials for clinical applications. Functionality to these forms is achieved through custom chemistries, which facilitate the attachment of surface-tethered moieties or encapsulated therapeutic factors including drugs, genes and other active agents. NFB has developed the next generation of delivery vehicles that are more robust, biocompatible and responsive to their environment (temperature and pH sensitive) which triggers the smart release of the biomolecule facilitating targeted drug delivery to a specific site. This platform technology assigns a dual nature of diverse responsiveness and function to biomaterials, offering abundant possibilities in the fields of regenerative medicine. Tissue engineering complements and provides synergy to the research programmes at REMEDI. Tangible evidence of this includes the existence of 12 co-funded competitive grants between NFB and REMEDI researchers from Science Foundation Ireland, the Health Research Board, and the Dystrophic Epidermolysis Bullosa Research Association. These collaborative activities have resulted in 12 joint peer-reviewed journal publications and 25 joint conference proceedings.

BIOMECHANICS RESEARCH CLUSTER
Prof. Peter McHugh
The Biomechanics Research Cluster in the NCBES enjoys strong research interactions with REMEDI. Examples of these interactions include research programmes in the development of gene-eluting stents to promote re-endothelialization and stem cell mechanobiology. The former programme is funded by Enterprise Ireland and aims to develop next generation stents that would promote the growth of an endothelial layer after placement. The research brings together university researchers from medicine, science and engineering with the cardiovascular interest group in Galway University Hospital.

The stem cell mechanobiology focuses on studying the biological response of stem cells to mechanical forces. This work is being carried out in the orthopaedic and cardiovascular domains in line with the main translational targets of REMEDI. A significant catalyst in the development of the orthopaedic project was the recent sabbatical visit by Prof. Glen Niebur (Notre Dame, USA) at the NCBES to work on the project, funded under an SFI Walton Fellowship, working with an IRCSET-funded PhD student based in the Biomechanics Research Group.
Partners
Irish Academic Partners

Systems Biology Ireland (SBI) is a Science Foundation Ireland CRTI (Centre for Science, Engineering and Technology) that was established in 2009. SBI is an initiative between University College Dublin (UCD) and the National University of Ireland Galway (NUI Galway). SBI will ultimately be located between the Charles Institute of Dermatology based on the Belfield campus of UCD and REMEDI at NUI Galway.

Systems biology is a multidisciplinary biology-based scientific field that focuses on the characterisation and mapping of the interactions between the various elements of a biological system. It promises to unravel the complexity of the cell through the use of models that predict biological behaviour. SBI is building the foundations of the science through the development of platforms and expertise in systems biology by focusing on defined scientific projects. In order to achieve a systems level understanding, the conceptual framework to rationalise complex biological relationships is being derived from mathematical modelling. Fundamental aspects of stem cell biology are being studied using systems biology approaches.

The Centre for Research in Vascular Biology (CRVB) laboratory is located within the BioSciences Institute (BSI), University College Cork, Ireland. The BSI was opened in September 2002 and houses more than 200 scientists from various departments (Biochemistry, Food Science, Medicine, Microbiology, Neuroscience/Anatomy, Nutrition, Physiology, and Surgery). The CRVB also possesses a translational research area off campus at the Biological Service Unit (BSU). This facility will enable preclinical studies to be performed in state-of-the-art facilities.

The translational facility is designed to support preclinical cardiovascular studies including:
- Angiography- peripheral vascular, coronary, ventricle
- PCI- stenting- invasive / non invasive assessment
- Cardiac hemodynamics
- Press volume loops, FFR, CFR
- 2-D, 3D angiography
- Regional wall, myocardial infarct size and valve assessment
- Plaque area and volume assessment
- Coronary flow and ischemia analysis
- CT-PTT-anatomical, biochemical and functional analysis of heart and vasculature

The Institute of Immunology is the largest concentration of research immunologists in Ireland. It was established as a centre of research excellence in NUI Maynooth in 1999 and occupies purpose built facilities on the campus. The Institute leads the HRB National PhD programme in Immunology collaborating with Queens University Belfast and Trinity College Dublin. The Institute also leads the MSc Immunology and Global Health which attracts international students of high quality, as well as the Irish Aid funded “Combat Diseases of Poverty” consortium which is an educational and training exchange programme with partner Universities in East Africa. The Institute has collaborated with REMEDI since 2004 and the theme of inflammation/repair and cell therapy is one of the two strategic themes for the Institute’s research. This collaboration has now extended to education, with lecturers from both institutions teaching leading advanced studies in both Galway and Maynooth.

The Clinical Research Facility, Galway (CRFG) is a joint venture between Galway University Hospital (GUH) and the National University of Ireland Galway. This facility is supported by funding from the Health Research Board (HRB) and has been in operation since March 2008. The CRFG provides the infrastructure, physical space, facilities and expertise needed to support patient-focused research studies and clinical trials aimed at understanding a range of diseases, bringing the research work in these areas to the patient as speedily as possible. There are dedicated inpatient and outpatient facilities available for clinical trials in vascular and cartilage regeneration. The facility is based on campus at GUH and is ideally situated to support the clinical application of the high quality research being conducted in REMEDI.

The CRFG supports clinical research and clinical trials by:
- Dedicated Specialist Research Nurse Support
- Biostatistics Support
- Regulatory Support
- IT Support
- Biopspecimen storage and processing
- Collaboration on Seventh Framework Programme (FP7)
- Education Programmes

The CRFG provides access to a wide range of clinical specialists and networks to facilitate single centre and multi-centre clinical research trials in regenerative medicine.

Study Application Process

- The CRFG Supports Clinical Research and Clinical Trials by:
  - Dedicated Specialist Research Nurse Support
  - Biostatistics Support
  - Regulatory Support
  - IT Support
  - Biopspecimen storage and processing
  - Collaboration on Seventh Framework Programme (FP7)
  - Education Programmes

CRFG BENEFITS TO INDUSTRY

- Skilled staff
- Our team can provide a range of services to facilitate delivering industry-led clinical trials
- Cost Effectiveness
- The CRFG provides a cost effective and competitive service
- Efficiency
- We have a dynamic team with streamlined processes to enable efficient clinical research project start up and delivery

Study Application Process

1. Principal Investigator completes Application Form and submits to CRFG Study Review Board
2. Study Review Board reviews application for scientific merit
3. Principal Investigator informed that study in approved and feasibility meeting is arranged
4. Service Level Agreement developed and agreed
5. Study commences
International Academic Partners

REMEDI has multiple international academic partners including the following:

- Mayo Clinic
- Georgia Institute of Technology and Emory Center for Living Tissue (GTEC)
- Wake Forest Institute for Regenerative Medicine (WFIRM)
- University of Arizona- Center for Gamma Ray Imaging
- Cleveland Center for Regenerative Medicine
- Centre for Tissue Engineering, Cardiff University
- Faculty of Medicine, Charles University, Prague
- National Cancer Research Centre, Genoa
- Technischen Universität München, Munich
- Erasmus University, Rotterdam
- Singapore Stem Cell Consortium

MAYO CLINIC

Dr. Windebank received his B.A. and M.A. degrees in Biochemistry and M.D. degree from Oxford University in England followed by post-doctoral training at Oxford University, Mayo Clinic College of Medicine and Washington University in St. Louis. Dr. Windebank served as the Dean of Mayo Graduate School from 1992 to 1998 and the Dean of Mayo Medical School from 1998 until 2005. Since 2005 he has been involved in the development and leadership of the Centre for Clinical and Translational Sciences at Mayo Clinic. Dr. Windebank is a neurologist who specializes in the diagnosis and treatment of patients with diseases of the peripheral nervous system and spinal cord. Since 1980 he has been involved in the design or conduct of more than 50 clinical trials and clinical studies. He has been recognized by a number of national and international awards that include the ETS Walton Fellowship of the Science Foundation of Ireland and a Doctorate (Honoris Causa) from Paracelsus Medical University in Salzburg.

GEORGIA INSTITUTE OF TECHNOLOGY AND EMORY CENTER FOR LIVING TISSUE (GTEC)

Dr. Robert Nerem joined Georgia Tech in 1987 as the Parker H. Petit Distinguished Chair for Engineering in Medicine. He serves as the Director of the Georgia Tech/Emory Centre (GTEC) for Regenerative Medicine, a centre established by a National Science Foundation (NSF) Engineering Research Centre award in 1998. He received his PhD in 1964 from Ohio State University and joined the faculty there in the Department of Aeronautical and Astronautical Engineering, being promoted to Professor in 1972 and serving from 1975-1979 as Associate Dean for Research in the Graduate School. From 1979 to 1986 he was Professor and Chairman of the Department of Mechanical Engineering at the University of Houston. Prof. Nerem is the author of more than 200 publications. He is Fellow, American Association for the Advancement of Science; Fellow, Council of Arteriosclerosis, American Heart Association; Fellow, American Physical Society; and Fellow, American Society of Mechanical Engineers (ASME). In 1992 he was elected to the Institute of Medicine of the National Academy of Sciences and in 1998 became a Fellow of the American Academy of Arts and Sciences. Prof. Nerem holds honorary doctorates from the University of Paris, Imperial College London, and Illinois Institute of Technology. His research interests include biomechanics, cardiovascular devices, cellular engineering, vascular biology, tissue engineering and regenerative medicine.

WAKE FOREST INSTITUTE FOR REGENERATIVE MEDICINE (WFIRM)

The Wake Forest Institute for Regenerative Medicine is part of Wake Forest University Baptist Medical Centre in Winston-Salem, North Carolina and is one of the leading institutes in tissue engineering and regenerative medicine in the USA. The centre has built up a significant reputation in the development of tissue engineering and regenerative medicine and is renowned for development from concept to translation in the clinic. Together with the Network of Excellence for Functional Biomaterials (NFB), REMEDI has formally signed a Memorandum of Understanding with WFIRM through Prof. David Williams, who is based at Wake Forest University. The agreement will facilitate the establishment of student and faculty exchanges, research collaborations and the co-development of translational regenerative medicine-related projects.
Cardiovascular
Members of this research group include
Interventional Radiology - Dr. G O’Sullivan;
Vascular Surgery - Mr. Don Courtney;
Cardiology - Prof. Kieran Daly, Dr. Faisal Sharif, Dr. Jim Crowley, Dr. Brian MacNeill, Dr. Pat Nash; and
Cardiovascular Surgery - Mark da Costa and Dave Verasingham.

Wound Healing
REMDI is studying the application of stem cell biology, gene therapy and biomaterials science to wound healing. The research group has a special interest in diabetic foot ulcers, burns and epidermolysis bullosa. Clinical partners include
Diabetes - Sean Dinneen, Timothy O’Brien, Francis Finnane, Fidelma Dunne, Marcia Bell;
Plastic Surgery - Jack Kelly and others;
Dermatology - Pauline Marren, Trevor Markham, Leslie Ann Murphy; and
Podiatry - Caroline Macintosh.

Respiratory
REMDI is currently studying the application of gene therapy and stem cell therapy to treat acute lung injury with Prof. John Laffey. Clinical partners include Anesthetics - John Laffey; Respiratory - Anthony O Regan, Robert Rutherford, and JJ Gilmartin.

Orthobiologics

Focus on the REMEDI TRANSLATIONAL TARGETS

Critical Limb Ischemia (CLI)
Peripheral vascular disease (PVD) manifests as intermittent claudication or critical limb ischemia and is a major global health problem affecting 3-10% of the population. In the US alone, it is estimated that 8-12 million people suffer from limb ischemia and the PVD market is estimated to be worth in the region of $4 billion per annum. This disease burden is likely to consume increasing health care costs due to the increase in prevalence of risk factors such as obesity and diabetes mellitus. The latter is particularly important as it is assuming global pandemic proportions and is expected to increase in prevalence in association with an ageing population. The treatment of choice for critical limb ischemia is restoration of blood supply via surgical bypass or angioplasty. A significant proportion of PVD patients are unfortunately not suitable for re-vascularization and amputation is frequently required for these ‘no option’ patients. New approaches to this debilitating condition are urgently required and REMEDI is developing novel approaches using stem cells, gene therapy and biomaterials.

Osteoarthritis
Osteoarthritis (OA) is a degenerative disease of joints and the most common musculoskeletal disease disorder. Apart from being a major contributor to premature death and disability, the incidence and impact of the disease will increase exponentially with increasingly ageing populations accompanied by the rising prevalence of obesity, the principle non-genetic risk factor for the disease. OA is a complex condition of broad pathology with loss of or damage to articular cartilage being a consistent element, accompanied by changes to the subchondral bone and synovium. Current treatments for OA primarily treat the symptoms of the disease, are not regenerative, and have little impact on the associated progressive degeneration of joint tissues. Stem cells may contribute to connective tissue homeostasis and repair, and these cells have been used to repair both cartilage and bone lesions. Local delivery of the cells to an affected joint has also been shown to result in improved outcomes. Future therapeutic options include the development of strategies to recruit and activate endogenous progenitors and the REMEDI Orthobiologic group is primarily focused on developing targeted and efficacious treatments for this debilitating chronic disease.
Irish Clinical Research Infrastructure Network (ICRIN)

REMDI is committed to collaboration with hospitals and clinical research facilities throughout Ireland in achieving its translational goals. The vehicle for this collaboration is the Irish Clinical Research Infrastructure Network (ICRIN), which is described here:

The Irish Clinical Research Infrastructure Network (ICRIN) was established in 2006 by five academic partners (NUI Galway, RCSI, TCD, UCC and UCD) and its preparatory phase is funded by the Health Research Board and the Health Service Executive, with additional support from Enterprise Ireland. ICRIN operates as a business unit of Molecular Medicine Ireland.

ICRIN Vision

Ireland as a country of choice for scientifically relevant multi-centre clinical studies and trials in specialist fields where partners are strong.

ICRIN Objectives

- Standardisation of approach to clinical research nationally through
  - Research Readiness driving process harmonisation
  - Clinical Research Education and Training
  - Network development activities:
    - Support the establishment of disease networks
    - Promoting a strategic approach to biobanking
    - Development of a biomarker network
    - Proposing strategic approaches to the development of a national infrastructure for clinical research.
- Enabling investigator led, multi-centre clinical trials and other research activities by networking the clinical research centres of MMI’s five partner institutions and other research teams.
- Engaging as the Irish scientific partner of the European Clinical Research Infrastructure Network (ECRIN) and the Biobanking and Biomolecular Resources Research Infrastructure (BBMRI) to build a European infrastructure for academic-led clinical research and biobanking activities;
- Supporting indigenous innovators and small to medium enterprises (SMEs) in accessing the clinical resources they need to bring their products to market.

ICRIN Personnel

Clinical Director: Dr Larry Egan, Professor of Clinical Pharmacology, NUI Galway
ICRIN Coordinator: Marie Mellody
ICRIN Correspondent /ICRIN Senior Associate: Siobhan Gaynor
Clinical Trials Liaison Officer: Fionnuala Gibbons

For further information on ICRIN, please visit the website www.molecularmedicineireland.ie

Industry Partners

Creganna-Tactx Medical

www.cregannatactx.com

Creganna-Tactx Medical is an independently owned Irish company that creates, designs and builds products and technologies for medical device and life science companies. Based in Galway, Ireland and Marlborough, MA USA, the company currently employs over 500 staff and was ranked 39th in the 2007 Deloitte Technology Fast 50 list, a ranking of the 50 fastest growing technology companies in Ireland and the company has grown on average 24% per annum over the past 5 years. Creganna-Tactx Medical is currently ranked among the Top 10 global outsourcing providers to the medical device industry.

Creganna-Tactx Medical has specialist expertise in the design, development and manufacture of specialty needles and delivery device shafts used in catheter-based minimally invasive procedures. The company operates a dedicated Innovation Centre where innovative metal, polymer and injection moulded solutions for medical device applications are developed and commercialised. Creganna-Tactx Medical is regarded as the world leader in hypotube-based device shafts.

“...A partnership with REMEDI enables Creganna-Tactx Medical to participate in the next generation of medical therapeutics. The advent of convergent medicine is an exciting prospect for our industry – medical treatments that combine a number of medical and life science specialties. Through its cross-industry partnerships REMEDI is uniquely positioned to enable such convergence.”

Maura Leahy, Creganna-Tactx Medical

EnBIO

www.enbiomaterials.com

EnBIO has developed a novel, low temperature and low cost processing technology for the application of materials onto metal surfaces such as titanium, CoCr, NiTi, and stainless steel. The patent pending technology known as CoBlast™ has to date been focused on treatments for hard tissue implants. EnBIO is working to exploit this technology with its OsteoZip™ surface for enhancing cell adhesion onto orthopaedic and dental devices. A second application area involves the incorporation of drugs into the CoBlast deposited bioceramic coatings. The recently launched OsteoZip™ is an infection-preventing surface for any implants. The flexibility of the CoBlast process offers enormous potential. It can be used to deposit novel functionalities to the surface of any metallic implant. Compared with conventional processing technologies, no high energy plasma sources, vacuum systems or chemical solution containment are required. EnBIO believes that this capability will lead to the development of new ideas and product concepts not heretofore considered. EnBIO offers a fully integrated single supplier solution for end-user surface modification requirements. This includes support and consultancy to tailor the CoBlast process to meet end-user surface requirements, as well as the supply of equipment and media.

“...EnBIO is very excited about its pending partnership with REMEDI and the potential of this relationship to significantly enhance the novelty of the medical implant surface technologies which EnBIO can offer its customers and the potential benefits that will eventually be experienced by patients”

John O’Donoghue, EnBIO’s founder and CTO
Prof. Timothy O’Brien, Director REMEDI for many years to come” and productive collaboration with Medtronic.

“We are very excited to continue our fruitful or therapy. Anther life is improved by a Medtronic product and therapies – every four seconds, a new life is improved by a Medtronic product or therapy.

“‘We are very excited to continue our fruitful and productive collaboration with Medtronic for many years to come.’

Prof. Timothy O’Brien, Director REMEDI

Medtronic is the global leader in medical technology, alleviating pain, restoring health and extending life for millions of people around the world. The company was founded in 1949 in Minneapolis, Minnesota, USA, and today employs more than 38,000 people worldwide. Medtronic has been present in Ireland since 1999. Medtronic now provides a wide range of products and therapies – every four seconds, another life is improved by a Medtronic product or therapy.

Ovagen

Ovagen is a biotechnology company that has developed a process of producing germ free (GF) chicken eggs and GF birds in commercial quantities for use primarily in the pharmaceutical industry. The Ovagen team has a wealth of experience:

• Ovagen’s Research and Development team have 100 years of combined life-sciences related R&D experience. Ovagen’s CEO’s previous venture was sold in 2002 to Charles River Laboratories Inc and the company’s operational team has a combined 75 years of life-sciences related experience.

• Ovagen has received patent protection in both Europe and the US for the process by which it produces GF eggs, further patent approvals are pending.

• Ovagen has achieved proof of concept (GF chickens have been bred through 3 generations) and funds have been raised for the construction of a production facility which will be used to produce the initial flocks of GF birds (for subsequent expansion into new large-scale GF facilities) and GF eggs, initially for customer validation.

• The methods used by Ovagen are covered by significant IP protection including granted patents

“This collaboration will allow further development of the Ovagen transgenic chicken platform for the generation of recombinant proteins to GMP standard. Development of this technology will add value to Ireland’s capability in the production of novel biotherapeutics.”

Iain Shaw, Ovagen

Proxy Biomedical

Proxy Biomedical Limited is an indigenous Irish company focused on translational research and development. The company is part of the vibrant life science cluster in Galway and is a leading innovator in the development of next generation medical products using proprietary biomaterials technology. The company is focused on the research, development, and manufacturing of medical devices used in surgery, tissue engineering, and pharmacology. Experienced medical device professionals and project managers’ work within state of the art facilities and provide a timely response to market-driven clinical requirements.

Proxy Biomedical has produced tissue engineering biomaterials with unsurpassed biologic and mechanical properties that can be used to create a controlled extra cellular matrix (ECM) through guided tissue regeneration. Some of the products have been approved for clinical use and are being sold commercially, while other product platforms are in development. The tissue engineering biomaterial can be used independently or in combination with molecules, growth factors, cytokines, and other factors that have a favourable impact on cell expansion, differentiation, and remodelling.

Proxy Biomedical is focused on biomaterials for healthcare procedures that are increasingly being performed on a younger and more active patient population. This trend requires that biomaterial-based medical devices assist in the regeneration of tissue with full or partial restoration of the patient’s quality of life. Tissue engineering is a field combining biomaterial research, molecular biology, chemistry, and medicine. Proxy Biomedical Limited has positioned itself as a partner in the design, development, and production of biomaterials in the converging field of tissue engineering.

“Proxy Biomedical looks forward to providing advanced biomaterial solutions to REMEDI, to address a range of clinical applications in the converging field of tissue engineering.”

Niall Rooney (BE, PhD), Orthopaedic Programme Manager, Proxy Biomedical Ltd.

Ziel Biopharma

Ziel Biopharma Limited (Ltd) is an innovative biopharmaceutical company whose core technology is the encapsulation of living cells for a variety of therapeutic purposes using Sodium Cellulose Sulphate (SCS). Ziel Biopharma Ltd is dedicated to research and development of innovative cell therapeutic drugs against diseases with high clinical unmet needs including cancer, diabetes and cardio-vascular disease.

Ziel Biopharma Ltd is part of Ryan Group Holdings, based in Limerick, Ireland, with an office in Vienna, Austria. Ziel Biopharma Ltd provides an encapsulation service to the pharmaceutical industry, life-science companies, biotechnology companies’ researchers and academics.

This unique drug delivery system allows for targeted therapy and can be used for the treatment of many diseases through the encapsulation of cells for therapeutic purposes, including: Cardiology, Immunology, Oncology, Metabolic Diseases, Inherited Diseases, and Infectious Diseases.

“Ziel encapsulates cells in a protecting polymer for therapeutic use. The collaboration with REMEDI is an important initiative in an area of unmet medical need.”

Gerard Ryan, CEO, Ziel

PARTNERS
ProCure Laboratories Ltd.
ProCure Laboratories Ltd is an EU and Enterprise Ireland-backed Regenerative Medicine R&D company, founded as a spin out from REMEDI in 2007. ProCure specialises in the GMP-grade isolation and expansion of mesenchymal stromal/stem cells (MSC) from human bone marrow (BM) for therapeutic application in orthopaedic, ischemic and autoimmune diseases. ProCure R&D is focused on the development of stem cell preparations and reagents for the research market. In addition, ProCure is exploring reagents and technologies that reduce the costs of manufacturing a clinical-grade MSC therapeutic whilst maintaining therapeutic potency. As a partner within the FP7-funded ‘PurStem’ consortium (www.purstem.eu), ProCure has recently identified a novel reagent that permits direct isolation of pure MSC from human BM.

To work with, or learn more about ProCure Laboratories contact Dr. Steve Elliman, Head of R&D: steve.elliman@procure-labs.com
Instrumental to the success of REMEDI’s research is the cell culture facility, comprising ten purpose built suites for the isolation and culture of primary cells and established cell lines. It possesses a full complement of molecular biology and functional genomics equipment. All of the rooms are specified to Class II Biosafety Level with one room specified for Class II+ Biosafety Level if required.

Cell Culture Core

Flow Cytometry Core

Flow cytometry and fluorescence activated cell sorting (FACS) are powerful techniques for analysing and isolating complex mixtures of cells and particles. Led by Prof. Rod Ceredig, Dr. Shirley Hanley and Dr. Siobhan Gaughan, REMEDI has developed state-of-the-art facilities, expertise and protocols in flow cytometry and FACS with an emphasis on applying these tools to the field of Stem Cell Therapeutics. The Flow Cytometry Core Facility houses two FACSAria™ II Cell Sorters, a FACSCanto™ Flow Cytometer (BD Pharmingen), an Accuri® C6 Flow Cytometer, a Bio-Plex™ multi-plex system (Bio Rad) and a complementary suite of analysis software packages. Ongoing applications of these technologies at REMEDI include single cell cloning of genetically-labelled MSC, screening of novel antibodies to human stem cells, sorting of rare progenitor cells (< 0.01% of total number) from human bone marrow and analysis of activation, proliferation and intra-cellular cytokine production by immunological cells during in vivo disease models.

Flow Cytometry Core Facility includes two FACSAria™ II Cell Sorters, a FACSCanto™ Flow Cytometer (BD Pharmingen), an Accuri® C6 Flow Cytometer, a Bio-Plex™ multi-plex system (Bio Rad) and a complementary suite of analysis software packages. Ongoing applications of these technologies at REMEDI include single cell cloning of genetically-labelled MSC, screening of novel antibodies to human stem cells, sorting of rare progenitor cells (< 0.01% of total number) from human bone marrow and analysis of activation, proliferation and intra-cellular cytokine production by immunological cells during in vivo disease models.

Imaging Core

The imaging core is led by Prof. Peter Dockery, Head of Anatomy. Imaging is one of the fundamental tools underpinning nearly all aspects of modern biomedical research. The provision of and adequate access to quality imaging technologies is an essential component of the research activities conducted by REMEDI. There is an extensive arsenal of imaging technologies available to the researchers in REMEDI including:

- a range of Research Level Light Microscopy/Basic Fluorescence Microscopes
- 2 Transmission Electron Microscopes
- 3 Scanning Electron Microscopes, Image Analysis Workstations (Including CAST system MIMICS)
- 2 Optgrid Confocal Systems
- 6 Confocal Microscopes
- 2 Laser Scanning Confocal Systems (1 Spinning Disc)
- Multiphoton Confocal Microscope
- Alba Inverted Advanced Fluorescence Systems (FLIM/PCS)/FCCS Alba Upright Advanced Fluorescence System
- Confocal Raman spectrometer & Avalon Instruments process system
- Fluorimeter 200 fluorescence lifetime spectrometer
- multiple steady-state fluorimeters
- Fast gated ICCD-FLIM (under construction)
- a TIRF microscope system.

Preclinical Core

Within REMEDI, there is a full-service preclinical research facility. With its dedicated surgical team and state-of-the-art technology, the preclinical facility offers a wide array of general research capabilities, such as services to produce in vivo, clinical pathology, necropsy and histopathology data for new research studies. The highly skilled surgical staff can offer individualised protocols and customised surgical models; have experience with pharmaceuticals, recombinant proteins and toxicology studies. The two surgical suites are equipped with inhalation anaesthesia capabilities with positive pressure ventilation, active anaesthesia scavenging and advanced patient monitoring systems.

Histology Core

The histology facility established by REMEDI in 2004 with funding from Science Foundation Ireland, provides histological services for investigators across the NUI Galway campus, the clinical services institute, University Hospital Galway, Galway Mayo Institute of Technology (GMIT) and local pharmaceutical/medical device companies. With a dedicated and highly skilled staff, the facility provides a range of services for both human and animal tissue including; processing and sectioning of paraffin embedded specimens, processing and cryosectioning of frozen sections, microdissection of tissues to capture RNA/DNA and or protein, skeletal preparation and staining of cartilage and bone, routine and special stains, immunohistochemical/immunofluorescence staining, antibody titration/optimization, digitization of data and protocol development for tissue collection and procession.

Gene Vector Core

The gene vector core facility provides scientists with non-viral and viral vectors to support research carried out within REMEDI. Viral vectors are produced in a Biosafety level 2 facility within REMEDI. Expertise exists in non-viral vector systems including electroporation and liposomes. Viral vector systems currently being used include adenovirus, adeno-associated virus and lentivirus. Core services include: Transfection and transduction of gene-specific viral DNA provided by the researcher; large scale virus production, purification and titration of the relevant virus; and technical assistance in cell culture and viral preparations.
The National Good Manufacturing Practice (GMP) Facility is a 250m² state-of-the-art cleanroom, housed in the National Centre for Biomedical Engineering Sciences (NCBES) at NUI Galway. The facility will translate stem cell research from the REMEDI research programme into cell-based medicinal products for clinical phase trials in patients.

The National GMP facility is a versatile cleanroom with standout features including two parallel production suites comprising six manufacturing rooms capable of clinical-grade manufacturing of cellular therapy products, gene therapy products and small molecules for therapeutic applications. The facility is serviced by dedicated utilities including CO2, on-site Liquid Nitrogen generation and HEPA-filtered air. The facility is staffed by dedicated GMP personnel and has implemented a Quality Management System (QMS) to ensure full compliance with EU legislation for manufacture of cell-based IMP. The facility is custom designed with switchable and validated air pressure gradient system to isolate manufacturing, intermediate and gowning/de-gowning rooms from each other. The facility also has a Quality Control (QC) testing laboratory and an automated monitoring system. The facility undergoes environmental monitoring, including touch and settling plates and active air sampling with alert and action levels.

The National GMP Facility is certified as an EU GMP Annex 1-compliant cleanroom and is recertified as a cleanroom on an annual basis. This certification is a key step towards achieving a licence from the Irish Medicines Board (IMB) to manufacture and cryopreserve clinical-grade cellular therapeutic products for human administration. The facility is on schedule to achieve IMB accreditation. The National GMP Facility represents the apex for translation of REMEDI research to the clinic in settings of unmet medical need such as Osteoarthritis (OA), Diabetes Mellitus, Crohn’s Disease and Peripheral Vascular Disease. The GMP Facility together with the Clinical Research Facility (CRF) at Galway University Hospital represents a significant and unique opportunity to translate cutting edge stem cell research at REMEDI into effective therapies for patients in Ireland.

Laura Bree embodies the success of our outreach programme. Laura participated in our stem cell research and ethics workshop and the Galway regional debate competition. In 2005, she won the REMEDI Annual Science Essay competition, and went on to study biomedical engineering at NUI Galway winning the SFI Young Women in Engineering Scholarship in 2006.
In keeping with international best practice, all current REMEDI PhD students are enrolled in the formal structured Graduate Research Education Programmes at NUI Galway. REMEDI is participating in a number of multicentre interdisciplinary graduate programmes including:

PhD programme in Biomedical Engineering and Regenerative Medicine

An NUI Galway-coordinated programme led by Prof. Peter McHugh with international academic and medical device industry partners. The programme includes industrial and clinical placements to help train students to become future R&D leaders.

Molecular Medicine Ireland Translational Research Scholars Programme

This NUI Galway-coordinated structured PhD programme led by Prof Laurence Egan in clinical and translational biomedical research focuses on patient and disease oriented research. It aims to produce scientists trained to translate discoveries into clinical and commercial application.

Graduate Programme in Molecular and Cell Biology of Human Health

A Trinity College Dublin (TCD)-coordinated structured graduate education programme led by Prof. Marina Lynch aimed at examining the molecular and cellular mechanisms underlying inflammatory processes.

Structured PhD Programme in Simulation Science

This University College Dublin (UCD)-coordinated graduate programme is linked to Systems Biology Ireland and led by Prof. Adrian Ottewill. It focuses on the application of multi-scale, multi-component modelling and the analysis of large multi-dimensional datasets.

Dr Linda Howard

Dr Linda Howard is a Lecturer in Regenerative Medicine at NUI Galway. She was involved in developing the MSc in Regenerative Medicine and is the current course coordinator. She lectures to undergraduate and postgraduate science and medicine students. Dr Howard completed her PhD at the Medical Research Council Toxicology unit in the UK. Following postdoctoral research fellowships at the Lombardi Cancer Centre in Washington DC and Memorial Sloan Kettering Cancer Centre in New York, she moved to Osiris Therapeutics in Baltimore, Maryland. Osiris is one of the companies leading the commercialisation of stem cell-based therapies. Her research interests centre on the regulatory networks involved in controlling stem cell differentiation, particularly the roles of microRNAs. She brings her industrial background and her research experiences to teaching and to research at REMEDI.

In 2007 NUI Galway launched a 1-year taught MSc in Regenerative Medicine, one of the first of its kind worldwide.

The course is coordinated and taught by members of REMEDI. This course accepts between 15-18 students each year and has already established itself as one of the most sought-after postgraduate taught MSc courses at NUI Galway.

This course includes modules in Regenerative Medicine, Immunology, Translational Medicine, Tissue Engineering, Advanced Research Techniques, Pharmacology and Scientific Writing. In addition, students select options according to their interests such as: Introduction to Business, Human Body Function, Introduction to Biomedical Systems, Anatomy and Health Economics. Students conduct a summer-long independent research project. Previous completed projects have taken place within REMEDI, NUI Galway, Galway University Hospital, Athlone Institute of Technology, NUI Maynooth and Royal College of Surgeons Ireland.

Graduates from the MSc in Regenerative Medicine are now working in R&D in biotechnology and biomedical device companies in Ireland and abroad; engaged in PhD studentships in Ireland, England, Wales, Austria, Spain and Canada; enrolled in graduate entry medicine; or are practicing their medical specialties. In summary these graduates are involved in making meaningful contributions to this exciting and promising new discipline.
Clinician Scientist Training

Dr. Aonghus O’Loughlin

Dr. Aonghus O’Loughlin is undertaking a structured clinical scientist training program in REMEDI. He is undertaking a PhD in conjunction with a fellowship awarded from Molecular Medicine Ireland and is training as a specialist registrar in diabetes mellitus and endocrinology at Galway University Hospital. His supervisors are Prof. Timothy O’Brien and Dr. Sean Dinneen. His project focuses on development of regenerative therapeutic approaches to diabetic foot ulcers, a major cause of morbidity and mortality in Ireland and internationally.

Dr. Bairbre McNicholas

Dr. Bairbre McNicholas is a national SpR academic Fellow completing her training at Galway University Hospital and with the REMEDI group at NUI Galway. As part of her PhD studies, she is studying diabetic kidney disease (diabetic nephropathy), currently the commonest cause of kidney failure in the Western world. Specifically, she aims to provide insight into the role of inflammation in in vivo animal and human studies of diabetic nephropathy. Her research explores the contribution of interleukin 6 (IL-6) to the onset and progression of diabetic nephropathy (DN). In addition, clinical training in Nephrology will be ongoing throughout the fellowship.

Dr. Conall Denney

Dr. Conall Denney is a combined research and clinical fellow in endocrinology. He is a trainee on the newly introduced National SpR Academic Fellowship Programme (NSAFP). This is a joint initiative of the HSE and HRB, which facilitates trainees to undertake a structured research programme to complete a PhD, while continuing with their clinical training. Dr. Denney is researching the impact of inflammation on the metabolic profile of obesity. His research has an emphasis on understanding the interaction between mesenchymal stem cells and inflammation in the complications of obesity. He is working under the supervision of Prof. Tim O’Brien and Prof. Matthew Griffin in Galway and Prof. Donal O’Shea of UCD and St Vincent’s Hospital, Dublin.

Mr. Cathal Moran

Mr. Cathal Moran, a fifth-year Specialist Registrar in Trauma and Orthopaedic Surgery at the Royal College of Surgeons in Ireland, is conducting his NSAFP-related PhD research through REMEDI in the area of cartilage repair. Cathal has previously completed a program of research in the area of cellular and tissue engineering-based spinal cord injury repair at REMEDI which led to the award of an MD degree, and shall build on this experience to complement the ongoing cartilage research at REMEDI. His clinical experience as a Specialist Registrar in Orthopaedic Surgery will help develop the translational elements of this research. In addition to working under the supervision of Profs O’Brien and Barry at REMEDI, Mr. Moran’s program also includes an international collaboration with recognised research and clinical specialists in this field at the Hospital for Special Surgery in New York and Harvard Medical School in Boston.
The objectives of REMEDI’s Outreach programme are to encourage people to take an active interest in biomedical science and to engage with contemporary research topics, to facilitate discussion amongst young people on the advances in the biomedical field and the societal and ethical impact of this research and to consider a career or education in this field, to explore complex conceptual topics in a controlled, unbiased, and balanced way and to develop communication and thinking skills.

Debating Science Issues is the 3-time Wellcome Trust-sponsored schools’ debate competition, developed by REMEDI and involving 8 partners at research, medical and science centres throughout the Republic and Northern Ireland. In Connacht, the ethical and societal implications of stem cell research are addressed in a round table discussion workshop aimed at kick-starting students’ preparation for the debates. Rounds of debates surrounding various biomedical topics culminate in a provincial final. This cross-border all-island project across 15 counties engages on average over 575 students annually. The All-Ireland finals are held at the Science Gallery at Trinity College Dublin every April.

REMEDI are active participants in the Hydra European Summer School on Stem Cells and Regenerative Medicine. In 2010 REMEDI Outreach personnel delivered a talk on the contemporary scientific issues addressed in REMEDI’s and other key education and outreach programmes. The session aimed to enthuse early career stage European scientists and encourage them to take an active role in communications at their institutes.

In the ‘Open Your Mind’ series of talks, experts from REMEDI and four other centres represented by the NUI Galway Region Outreach Network give non-specialist talks to university staff about their area of research interest.

REMEDI are a workpackage leader in the EU-funded EuroStemCell project, the aim of which is to create a coordinated platform for widespread dissemination of rigorous scientific knowledge spanning research fields of stem cell biology and regenerative medicine. For more information visit www.eurostemcell.org

“We believe that facilitating an active communication between research scientists and the general public is of utmost importance. As such we have developed an active Outreach programme at REMEDI over many years”

Dr. Kieran Ryan, Programme Manager, REMEDI
GAMBA
GAMBA (Gene Activated Matrices for Bone and Cartilage Regeneration in Arthritis) is a European Union funded research project focused on developing new methods for the treatment of osteoarthritis. In collaboration with nine partner institutions from Germany, France, Ireland, Italy, the Netherlands and Switzerland, researchers in REMEDI aim to promote the self-healing capacity of damaged cartilage and bone using the coordinated cooperation/interaction of gene vectors, mesenchymal stem cells, polymers and magnetic nanoparticles.

"GAMBA represents a very exciting multidisciplinary approach to the problem of osteoarthritis incorporating gene vectors, mesenchymal stem cells and novel biomaterials to promote cartilage repair in a coordinated fashion."
Dr. Mary Murphy

PurStem
PurStem is a project funded under Framework Programme 7 (FP7) of the European Union and is coordinated by REMEDI. The project brings together leading researchers in stem cell and regenerative therapy from across Europe with small-to-medium enterprises (SMEs) having specific industrial technologies and expertise. The objective of PurStem is to establish standard methods and tools for the production of large amounts of adult mesenchymal stem cells (MSCs) for clinical therapies.

www.purstem.eu

"Whereas the benefits of this project for society as a whole are significant, for stem cell research and development they are immense."
Prof. Frank Barry

ADIPOA
The ADIPOA Consortium (Adipose-derived stromal cells for Osteoarthritis) brings together a unique combination of expertise in stem cell biology, regenerative medicine, chondrocyte biology, osteoarthritis experimental models, clinical expertise and cell therapy licensing from 7 different European countries, with the final aim of developing an efficient adult stem cell therapy for osteoarthritis. The critical mass achieved by this consortium that comprises 14 partners, with researchers from public agencies, universities and 4 SMEs, should enable significant breakthroughs in stem cell engineering, which are directly amenable for clinical therapies. By demonstrating that autologous adipose stem cells are optimal candidates to stimulate the regeneration of injured cartilage, ADIPOA endeavours to create a biological solution for the, as yet unsolved, problem of cartilage repair.

EuroStemCell
The FP7 European consortium for communicating stem cell research, EuroStemCell, brings together the major EU-funded large scale stem cell projects, the European Clinical Research Infrastructures Network (ECRIN), and other internationally recognised European stem cell research centres. The aim is to create a coordinated platform for widespread dissemination of rigorous scientific knowledge spanning research fields of stem cell biology and regenerative medicine. It focuses on three dissemination routes: the web (www.eurostemcell.org), the provision of resources for direct public engagement and the provision of resources for educators. REMEDI leads a dedicated committee tasked to develop resources for public engagement, engage directly with key audiences, and to develop resources for educators.