Dear Colleagues,

With the establishment of CÚRAM, we have a tremendous opportunity to develop a positive, lasting impact not only on the healthcare industry and the increasing number of individuals affected by chronic illnesses worldwide, but on our economy and society at a global level.

Our key strength lies in our ability to create unique, synergistic networks across academic, industry and clinical institutions, bringing together a comprehensive set of tools, expertise and perspectives to progress medical device research and its clinical application in each of our disease target areas.

Because of this, our research and output capabilities in the medical device sector span a much wider spectrum than ever before and the possibilities for conceptualisation, discovery, development and clinical translation of innovative, ‘smart’ solutions to bring about a better future for patients of chronic diseases are very exciting.

Our confidence in the future of the Med Tech sector in Ireland is based on the talent, technical expertise and facilities we have, as well as the strong support and investment in the sector by the Irish Government and Science Foundation Ireland.

Ireland is already leading the field when it comes to medical device technology. According to IDA Ireland, seventeen of the world’s top 25 medical-technology companies have invested significantly in Ireland and there is a strong established cluster incorporating foreign and indigenous companies.

CÚRAM aims to build on this by taking the fruits of our research, new medical device products, to clinical trial, which will lead to further job creation and spin out Med Tech companies. Together with our academic and industry partners, CÚRAM will help create a sustainable future for the Med Tech sector in Ireland and train the next generation of world class Med Tech scientists and entrepreneurs.

Thank you for taking the time to learn about CÚRAM. We look forward to sharing our expertise, skills and successes with you in the future.

Sincerely,

Prof Abhay Pandit
Scientific Director
Centre for Research in Medical Devices (CÚRAM)
CÚRAM is the National Centre for Research in Medical Devices, backed by Science Foundation Ireland and industry funding. Our researchers are designing and manufacturing the next generation of ‘smart’ medical devices to improve health outcomes and enhance quality of life for patients with chronic illnesses.

With six academic partners and over 24 industry partners, CÚRAM is establishing a global hub of research expertise in medical device technology. Establishment of CÚRAM positions Ireland at the forefront of the world’s medical device industry - a leading area of innovation, employment and export in Ireland.

CÚRAM’s innovative approach incorporates biomaterials, drug delivery, cell-based technologies, glycosciences and device design to enhance, develop and validate both traditional and new combinational medical devices from molecular design stage to implant manufacturing.

Our devices are developed with strong clinical collaborations to enable rapid translation of research findings to clinical application. Key to this approach has been the establishment of a unique network of national and international collaborations, integrating world class clinical, academic and industrial partners.

KEY OBJECTIVES

- Establish a world leading Irish Medical Device R&D Centre to improve and enhance traditional medical devices and develop the next generation of biomedical implants, cell device and drug-device combination products to address unmet clinical needs.

- Partner with local SMEs and multinational medical device, biotechnology and pharmaceutical companies to create new employment opportunities.

- Create training in medical device research and clinical application for Industry, academia and clinicians.

- Develop Intellectual Property (IP) with commercial and clinical relevance and with licensing and spin out potential.
CÚRAM’s research is grounded in an understanding of medical implants and devices and the role they can play in providing structural support, function and diagnostic value and in augmenting the body’s repair and regenerative processes. Our research program focuses on innovative device design, assessment and manufacture and is driven by specialist researchers, clinicians and industry partners developing solutions for specific disease states:

**Cardiovascular**
Myocardial infarction, critical limb ischemia, syncope.

**Musculoskeletal**
Osteoarthritis, bone fractures, cartilage and disc degeneration, tendon injury.

**Neural**
Peripheral nerve and spinal cord injury, neurodegenerative diseases such as Parkinson’s and multiple sclerosis, pain and stroke.

**Soft Tissue**
Abdominal wall defects, hernia, chronic skin wound healing, corneal disease, skin ulceration and diabetes.

**Renal & Urology**
Acute and chronic kidney disease, diabetic nephropathy, interstitial cystitis.

**Respiratory**
Asthma, emphysema, lung inflammation.

## RESEARCH STRENGTHS

### Biomaterials and Drug Delivery

Controlled delivery of therapeutic molecules to injured tissue remains one of the greatest challenges facing the translation of novel drug therapeutics. Key segments of the medical device market are in urgent need of innovative materials-based platforms to deliver ‘hard-to-deliver’ biomolecular cargoes such as small molecules, nucleic acids, proteins and cells. CÚRAM develops targeted controlled drug release systems, drug-device combination products, and multi-component biomaterial-based selective delivery systems to deliver molecules and macromolecules to specific organs, cells and/or sub-cellular compartments. These functionalised biomaterials work synergistically with the biological host to improve or replace functionality.

These ‘smart’ functionalised biomaterial systems reduce adverse side-effect profiles, drug degradation and loss and increase bioavailability at the site of interest thus overcoming the limitations of existing drug-delivery systems. These platforms include electrically responsive materials, cyclic polymers and functional branched poly(amino acids), as well as peptidomimetics and glycan conjugates, representing the fastest growing classes of new drugs capable of selective delivery to specific organs, cells and/or subcellular compartments delivered via oral, dermal and topical routes.

These developed chemistries are being processed for clinical application and integration into medical devices to provide selective, delivery-release strategies for drugs. CÚRAM’s expertise in the application of biomaterials to disease targets ranges from target identification and lead optimisation through to formulation design, physicochemical characterisation, toxicity testing, bioavailability and efficacy in pre-clinical models.
**Tissue Engineering and Regenerative Medicine**

Tissue Engineering and Regenerative Medicine is a key area of research at CURAM with a goal of finding solutions to chronic health problems and addressing unmet medical need. Scientific advances in stem cells, gene therapy, biomaterials, medical device technology, growth and differentiation factors, as well as biomimetic environments have created unique opportunities to fabricate tissues in the laboratory from combinations of engineered extracellular matrices (“scaffolds”), cells, and biologically active molecules. In addition, use of these technologies to develop clinically translatable reparative and regenerative approaches is a major goal. Engineered matrices have taken a variety of forms such as injectable hydrogels, films, nanofibers and using nanoprinting technologies. With a focus on biomimetics and regenerative medicine, CURAM is developing innovative approaches, assays and tools for comprehensive and accurate analysis of complex biological systems and their interaction with medical devices and associated therapeutics. CURAM has a translational research focus utilizing GMP manufactured cells in early phase clinical trials in diseases such as diabetic vascular complications and osteoarthritis. This is enabled by critical infrastructure for GMP cell manufacturing and a specialized clinical research facility.

**Glycoscience**

Glycoscience is the study of the unique biochemical language of glycans (complex sugars) which play a crucial role in most biological processes such as reproduction, signalling, cell differentiation, immunity, inflammation and diseases including cardiovascular disease. Researchers at CURAM are profiling the functions of glycosaminoglycans (GAGs) and other constituent carbohydrates, with the aim of developing compositions for use in modifying biomaterials for biocompatibility, pushing stem cells toward correct differentiation pathways, drug delivery with tissue specific cell homing ability and building immune responses. Major goals of the research are to develop fingerprints of carbohydrates using microarrays to develop novel protein and nucleic acid based recognition molecules specific for individual carbohydrate molecules.

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**Device Design**

To keep pace with health care reform and advancing medical technologies, it is necessary to re-engineer existent medical products and to deliver new options for economical, faster and more efficient patient care, thereby reducing the socio economic burden and morbidity associated with repeat procedures.

CURAM is modifying the design and manufacture of current interventional and delivery devices to improve efficacy and minimise impact, improve the delivery of biomolecules and combination products at target sites and to develop relevant prototypes. Our researchers are assessing the physical characteristics of healthy and diseased tissues and specific tissue interactions with devices to assist with the development of new concepts. Our expertise in the field of bioelectronics covers the use of biomaterials and biological architectures for information processing systems and development of new devices. CURAM researchers have recently developed a range of analytical and computational models addressing cellular level responses, biodegradation and fatigue behaviour and can apply these methods to inform device design prior to clinical evaluation. These models can assign material properties that mimic the target environment allowing researchers to virtually implant devices and test disease scenarios to predict behaviour to facilitate less invasive and more efficient clinical applications and maximise healing and health outcomes.
CLINICAL TRIALS

Clinical trials are an essential step in creating medical devices that realise their full potential and ensuring the safety value of each new development. Without these trials, research cannot be translated into economic, health or societal benefits. With the establishment of CURAM, Ireland’s clinical infrastructure is now moving forward using a wide range of expertise to increase the number of clinical device trials carried out in Ireland.

Translation from a research setting to clinical application requires a high level of coordination and a variety of skill sets to ensure an efficient and cost effective approach. A key role for CURAM is the coordination of device trials that each involve their own challenges and complexities. To manage this, CURAM engages directly with the National Clinical Research Infrastructure Network which consists of five clinical research facilities with an extensive track record of early and late phase clinical trials for both industry and relevant clinical academic researchers. CURAM also has links with the hospital groups and academic partners created by the Irish Government as part of a significant reform of the health services.

This platform positions CURAM as a centre of excellence for transforming conceptual and technological innovations into clinically validated, ready-for-market, medical devices. CURAM also carries out education and training across clinical, industry and academic partners in the area of clinical trials in association with Molecular Medicines Ireland (MMI). Education and training are key to ensuring that this sector continues to grow and develop and that Ireland has the ability to meet future needs in medical device trials.

OUR TRACK RECORD

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<th>Economic, Health, IP &amp; Commercialisation</th>
<th>Human Capital, Skills &amp; Education</th>
<th>Industry Development &amp; Jobs</th>
<th>Conference Hosted</th>
<th>Workshops Hosted</th>
<th>MSC Graduates</th>
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<th>Senior Author Publications</th>
<th>Technologies Licensed</th>
<th>Microwave &amp; Applications</th>
<th>Investigator / Collaborators</th>
<th>Sponsored Clinical Trials</th>
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WORKING WITH INDUSTRY

Academic–industry–clinician driven projects carried out with CURAM are guided through a well-managed industry programme that offers new product introduction, scalability of device and conformance with medical device standards, favourable licensing terms and conditions and strict scientific and financial project reporting structures. Each project is assigned a senior principal investigator within CURAM and managed by our industry programme manager through measurable deliverables and project milestones.

CURAM works closely with the National Standards Authority of Ireland to develop harmonised EN and ISO standards to facilitate future market approval of clinically validated, ready-for-market, medical devices. We run a multidisciplinary research programme that explores novel methodologies and techniques to generate new, commercially relevant IP for industry and ensure that high value jobs are created and maintained in the medical device sector.

Advantages to industry partners are numerous and include the opportunity to be part of the national and international medical device sector development, as well as developing a competitive advantage by tapping into the latest research and innovations in the sector. Partnerships with the CURAM team provide access to expensive research equipment without the need for investment in capital equipment, the opportunity to access funding for R&D and to tailor research projects to specific industry requirements while maintaining an objective overview of research goals. Working with renowned experts in biomaterials, drug delivery, cell therapy, glycoscience and device design reduces the risk in ‘high risk’ research and contributes to market confidence and stability.

EDUCATION & PUBLIC ENGAGEMENT

CURAM will train over 250 researchers in biomaterials science, tissue engineering and regenerative medicine, glycoscience, pharmaceutical and nanomedicine formulation, device design, prototyping pre-clinical validation and clinical translation. CURAM’s postgraduate training programme will achieve a target of 50% of its trainees moving to industry as a first destination by 2020 and remedy a skills shortage in the medical device sector.

In addition, to help support and secure the future of its world class research capabilities, CURAM has developed an education and public engagement programme to engage primary and secondary students, teachers and the general public and to encourage more young people to take up Science, Technology, Engineering and Maths (STEM) subjects at senior and third level. The programme includes initiatives such as residency programmes for artists, writers and teachers, science in film projects, schools workshops and visits as well as collaborative projects with outreach partners and public engagement training for researchers.
EU FUNDING

CÚRAM's research themes are designed to align with the European Research Council, Marie-Sklodowska-Curie Actions and Horizon 2020’s programmes and our team has secured over €135.1M in total grant value (€25.2M CÚRAM team share) through previous EU Framework programmes. CÚRAM’s research areas are aligned with three, key enabling technologies of nanotechnologies, advanced materials and biotechnology that underpin Horizon 2020’s three key priorities of excellence in science, industrial leadership and addressing societal challenges. The CÚRAM team has a high level of involvement in a number of European and intergovernmental networks and continues to strengthen links with industry led stakeholder forums and the existing European Clinical Research Infrastructure Network to ensure a high level of competitiveness in achieving CÚRAM’s key objectives and securing funding to establish a sustainable world class Medical Device research centre for Ireland.

FACILITIES

- Biomaterials manufacturing and processing from nanoscale to macroscale level
- Extensive biomaterials and biological characterisation
- Physicochemical drug analysis
- Device design and testing
- National Biophotonics Imaging Platform (NBIP) including pre-clinical imaging
- Centre for Cell Manufacturing
- Preclinical disease models
- GMP Manufacturing
- Clinical research and trials infrastructure