Fully funded PhD Positions in Immunomodulation Research
University College Dublin
Ultrasound-Modulated Hydrogel Implant for Precision Bone Regeneration: Exploiting Immune Dynamics for Enhanced Healing.

About this Project: Bone, a vital tissue with remarkable self-regenerative capabilities, faces challenges in repairing large-scale defects, often leading to permanent loss and non-union fractures. While tissue engineering holds promise, its translation to clinical applications is hindered by inadequate understanding of biomaterial-immune system interactions. The complex orchestration of various cell types, particularly macrophages, underscores bone fracture healing. Macrophages transition from pro-inflammatory M1 to anti-inflammatory M2 phenotypes, crucial for effective regeneration. Dysregulation in this transition impairs inflammation resolution, hampering bone repair.

This proposal aims to develop a bone regenerative implant which exploits ultrasound-triggered hydrogels to modulate M1-M2 polarization, thus enhancing bone regeneration. Specific aims include developing a novel hydrogel for on-demand cytokine release, investigating spatiotemporal effects of M1-M2 polarization post-injury, and assessing BMP-2 mRNA nanoparticles for osteoblast differentiation. The project integrates interdisciplinary approaches to elucidate immune-regenerative dynamics and optimize hydrogel-based therapies for critically sized bone defects.

By deciphering the nuanced interplay between biomaterials, immune responses, and bone regeneration, this research offers insights crucial for advancing tissue engineering strategies towards effective clinical translation, potentially revolutionizing the management of large bone defects and fracture non-unions.

Curam PhD Studentships: A four-year PhD studentship award includes full tuition, a PhD stipend of €30,901 per annum (tax free) for participants not eligible for a family allowance or of €37,725 for those eligible for a family allowance and a research budget to cover research costs associated with the project. Students will be enrolled onto UCD's structured PhD programme which includes some taught elements and transferrable skills training providing an excellent foundation for a research career (www.ucd.ie/graduatestudies/researchstudenthub/researchprogrammes/).

Application Process: MedDevDoc is open to candidates who have a 1st class or a 2:1 honours first degree and have/are due to obtain a Master's in Biomaterials, Biomedical Engineering, Tissue Engineering, Cell Biology, Biology, Biochemistry, or related disciplines. From different genders and nationalities. They must not hold a doctoral degree. Medical Doctors are invited to apply if they can demonstrate an understanding of the clinical or life sciences research process. All applicants for whom their first language is not English must present an English language qualification taken within two years before the application (Suggested English language qualifications include IELTS, Cambridge C1 Advanced, Cambridge C2 Advanced, TOEFL iBT/TOEFL iBT Home Edition, Pearson PTE and Duolingo). Applicants must not have resided or carried out their main activity in Ireland for more than 12

months in the last 3 years prior to the call deadline. **For more information please see https://curamdevices.ie/curam/research/meddevdoc/application---selection-process/**

About the research team: Dr Fiona Freeman is an Ad Astra Fellow, a Conway Fellow, a funded investigator in the SFI Research Centre in Curam and Advanced Materials and Bioengineering Research, and a PI within UCD Centre for Biomedical Engineering and Trinity Centre for Bioengineering. Dr. Freeman leads a multidisciplinary research group investigating the use of innovative biomedical engineering techniques to better understand and develop novel therapeutics to treat damaged or diseased bone. For more information, please see www.ucd.ie/freemanlab/.

About MedDevDoc: MedDevDoc is the successor Industry-Academia Training, Career Development and Mobility Studentship Programme at CÚRAM, Science Foundation Ireland (SFI) Centre for Research in Medical Devices to MedDevDoc 101126640 (Dec 2023 to Nov 2028). The MedDevDoc Programme aims to train biomedical doctoral candidates in multidisciplinary, intersectoral, and transferable skills for next-generation medical device development. Education shall be based at one of ten CÚRAM academic organisations: University of Galway (GALWAY), University College Dublin (UCD), The Royal College of Surgeons in Ireland (RCSI), Trinity College Dublin (TCD), University of Limerick (UL), Dublin City University (DCU), Technological University of the Shannon (TUS), University College Cork (UCC), National Institute for Bioprocessing Research and Training (NIBRT) and Technological University Dublin (TU Dublin). Also, CÚRAM's industry partners (Associated Partners) will supervise and train students during intersectoral secondments.

About Curam: CÚRAM, the Centre for Research in Medical Devices, is a national, SFI-funded, €68.4m research centre based out of the University of Galway. CÚRAM's prime objective is to radically improve health outcomes for patients by developing innovative implantable 'smart' medical devices to treat primary unmet medical needs. CÚRAM industry partners include Irish companies and multinationals in the medical device, pharmaceutical, and biotechnology sectors. CÚRAM's vision is to be a global leader in creating and translating clinic-ready and patient-focused medical devices, develop the next generation of industry-relevant, publicly engaged researchers, and become an anchor for industry-applicable research.

About Marie Skłodowksa-Curie Fellowships: The MedDevDoc program is part of the Marie Skłodowksa-Curie Actions (MSCA), a European Commission funding program under Horizon Europe. Named after the double Nobel prize-winning Polish-French scientist Marie Skłodowksa-Curie, MSCA offer excellent and innovative research training, attractive career development, and knowledge-exchange opportunities across borders and sectors, e.g., academia and industry, Marie Skłodowksa-Curie Fellowships are internationally recognised as a mark of research excellence.

For further information and to apply please email Dr Freeman (she/her) at fiona.freeman@ucd.ie. **Call is open until 18th of August 2024.**