



Institute of Technology

Ciência sem Fronteiras / Science Without Borders

Postgraduate Project Template

Institution:	Waterford Institute of Technology
Title of Postgraduate Opportunity: (include level of study)	The Development of a Novel, Two-Phase, Polymeric Cryo-Foam with Controlled Drug Eluting Characteristics for Chronic Wound Healing Applications PhD
PI Name & Contact Details:	Dr Austin Coffey / Mr Philip Walsh Convergent Technologies Research Group Dept. Engineering Technology Waterford Institute of Technology, Ireland +353 51 302090 / +353 86 4041666 acoffey@wit.ie
Department/School:	Engineering
Research Centre /Group:	Convergent Technologies Research Group
Research Centre/Group website:	www.ctrg.ie
<p>Brief Summary of PI research / research group /centre activity</p> <p>The Convergent Technologies Research Group (CTRG) is a multi-disciplinary research cluster combining expertise in various fields of technology. The aim is to create a dynamic environment for collaborative research to deliver innovative solutions for convergent applications. Current research activities span a broad spectrum, ranging from infrastructural technologies (water, energy and the environment) through materials development (polymeric formulations, polymer processing and super-critical fluid enabled technologies) to passive and active medical devices (mock cardiovascular loops, catheter technologies and implantable platforms). CTRG has attracted significant funding and support from SFI, Enterprise Ireland, IOTI and multiple industrial partners; in the infrastructural, materials, microelectronic and biomedical sectors.</p> <p><u>Project Description:</u></p> <p>Ulcers that do not display conventional healing characteristics, as a result of biological/physiological factors and additional abnormalities, are typically referred to as chronic wounds. Such wounds arise as a direct result of underlying medical conditions and normally occur toward the extremities (leg, foot etc.), such as arterial/blood vessel complications, diabetes, open wound infection and neglected bedsores. If</p>	

not sufficiently treated in the early stages chronic wounds can cause severe complications and health risks. Traditional treatment methods have focused on externally applied drugs (in the form of lotions/ointments etc.) in conjunction with standard medical bandages. These techniques are inherently flawed, as they do not facilitate smart-monitoring capabilities; requiring the wound to be constantly re-dressed each time a diagnosis or treatment needs to be conducted. Furthermore, conventional techniques are particularly poor at maintaining a moist environment and allowing natural permeation of moisture and oxygen to occur at the wound-bandage interface. As a result, a knowledge gap exists, both in medical interventions and in documented scientific literature. This warrants the study, development and exploitation of smart wound healing techniques capable of providing moist, sterile environments and controlled drug release. Such a study would contribute significantly to the development of a novel medical technology with functionality far surpassing that of current wound dressing/healing techniques. Biomaterial hydrogels are three-dimensional polymeric structures capable of absorbing, holding and releasing large quantities of fluid. Furthermore, this novel class of polymers are porous by nature, allowing easy incorporation of drugs into the hydrogel matrix. These properties are immediately attractive in the context of smart wound healing artefacts. Optimally tailored biomaterials can permit controlled drug release (anti-inflammatory/anti-septic), wound-hydration control and site specific sterilisation. Development of such a device would prevent the onset of bacterial infection while the intrinsic properties of biomaterial hydrogels allows for all desirable mechanical, structural and functional attributes to be preserved. The proposed focus of this research is to develop smart biomaterial(s) with controlled drug release capabilities, accurately define, parameterize and metricize critical physical and chemical interdependencies, and to assess the technologies suitability for deployment in novel, wound healing applications.

Key Attributes of Project for Brazilian Postgraduate Students

The CTRG in partnership with the Pharmaceutical and Molecular Biotechnology Research Centre (PMBRC) at Waterford Institute of Technology and in collaboration with the Applied Polymer Technology (APT) Research Centre at Athlone Institute of Technology has access to state-of-the-art analysis, formulation and test equipment. Coupled with industrial support from leading medical device companies such as KCI Medical, FastForm Medical and Teleflex Medical, the exposure of world leading companies and their technical support will yield unparalleled benefits to the PhD student.

Name and contact details for project queries, if different from PI named above:

Dr Austin Coffey, acoffey@wit.ie

Please indicate graduate disciplines which are eligible for application:

Polymer Engineering
Materials Engineering
Mechanical Engineering
Electronic Engineering
Chemical Engineering
Physics

Alignment with Science Without Borders Priority Areas:

Please indicate the specific programme priority area under which the proposed postgraduate project fits – choose only one (tick box)

Engineering and other technological areas	X
Pure and Natural Sciences (e.g. mathematics, physics, chemistry)	
Health and Biomedical Sciences	X
Information and Communication Technologies (ICTs)	
Aerospace	
Pharmaceuticals	X
Sustainable Agricultural Production	
Green Chemistry	
Oil, Gas and Coal	
Renewable Energy	
Minerals	
Biotechnology	
Nanotechnology and New Materials	X
Climate Change	
Biodiversity and Bioprospection	
Marine Sciences	
Productive Inclusion and Social Technologies	
Housing and Sanitation	