

QUB - Mechanical and Aerospace Engineering PhD Project Description

Title: Novel Composite as coating for Bioimplants to Achieve Enhanced Functionality	
Theme: Biomaterials, advanced manufacturing	
<p>Project description: Millions of bone tissue graft procedures are performed worldwide on an annual basis to treat traumatic injuries, degenerative diseases, and tumour resections. Tissue harvested from the patient (autogenic) are the preferred tissue grafting materials, despite drawbacks and potential complications, because engineered materials have been unable to meet the diverse range of multifunctional requirements, which includes biocompatibility, biodegradation, mechanical properties, and porous structure.</p> <p>In this project, 3D printing techniques will be deployed for fabricating biodegradable scaffolds with customized geometry and controlled porosity and mechanical properties. The scaffold surface will then be modified by a novel composite coating consisting of biocompatible polymer and functional nanomaterials. The coating can be used to tailor the scaffold structure and properties, as well as modify the scaffold degradation profile. In addition, the coating will also serve as a multi-functional platform, which offers desirable properties such as bacterial resistance, therapeutic drug-delivery, photothermal therapy and promoting cell growth etc. Achieving these properties and functionalities with the high degree of customization will help address the major unmet need for engineered tissue scaffold materials as replacements for existing treatment strategies using autogenous grafts, which are limited in supply and efficacy.</p> <p>This interdisciplinary project will be conducted in collaboration with researchers from Mechanical Engineering, Material Sciences / Biomaterials, Medicine, and Pharmacy. Opportunities for secondment/collaboration with external laboratories in the UK/EU/China are anticipated.</p>	
<p>Aims and Objectives:</p> <ul style="list-style-type: none"> • Produce 3D printed scaffolds with controlled porosity and mechanical properties • Establish the methodology for nanocomposite coating preparation • Investigate the effects of coating on the 3D scaffold's porosity, mechanical properties, and degradation profile. • Demonstrate the multi-function of the coating material (e.g., drug delivery, anti-microbial resistance, etc) 	
<p>Key skills required for the post: Candidates should have completed an honours degree in mechanical/materials/biomedical engineering/pharmacy/physics/chemistry or a related subject. Knowledge or experience in the areas of mechanical behaviour of materials, materials processing and chemistry, materials characterisation, mechanical testing, designing/commissioning laboratory equipment, and experimental methods are desirable.</p>	
Key transferable skills that will be developed during the PhD:	
Lead supervisor:	Dan Sun
Other supervisor(s):	TBC
Funding mechanism:	Subject to funding availability
Application closing date:	Until suitable candidate appointed.
Guaranteed stipend:	This can include a basic stipend and any guaranteed top-up (if available). N.B. Stipend for 20-21 is not yet confirmed. Base stipend for 19/20 is £15,009.
Conditional top-up available:	TBC
<p>PhD students in the School may have the opportunity to apply to be demonstrators on undergraduate modules. Compensation for this can amount to in excess of £2,400 per year.</p>	

Queens University Belfast is a diverse and international institution which is strongly committed to equality and diversity, and to selection on merit. Currently women are under-represented in research positions in the School and accordingly applications from women are particularly welcome.