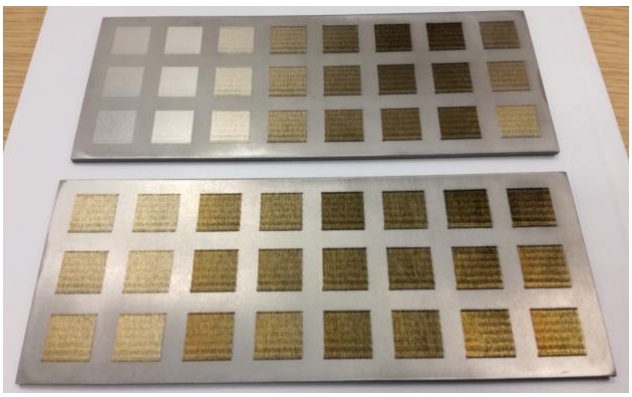
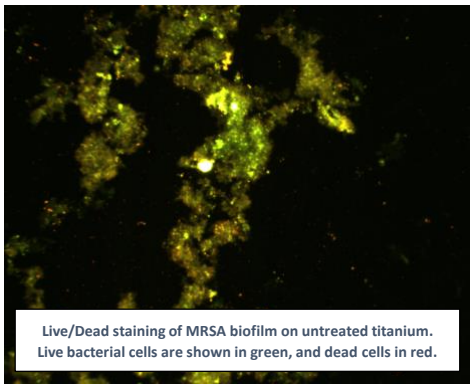
***Title of studentship**	**Surface Treatment for Improved Performance of Implantable Medical Devices**
Value / what is covered?	
Awarding body	
Number of studentships	1
***Summary descriptive text / Example of research project**	An ageing population has led to a strong global demand for orthopaedic prostheses, i.e. global orthopaedic implants market valued at USD 4.3 billion in 2015 [1]. Orthopaedic implants face the challenge of failure by aseptic loosening and bacterial infections, contributing to 30% and 16% respectively of total joint revision in the hip and knee [2]. Implant failure caused by bacterial infection can be catastrophic for both the patient, given that antibiotic therapy will be unsuccessful in treating the infection, and ultimately the patient will be required to undergo surgical removal of the implant. This scenario will also have a financial impact on the cost of care. Strategies to diminish bacterial infection can be classified into coating and non-coating approaches. Covering the implants with antibacterial-loaded materials by coating methods has the concern of short-term toxicity and long term loss of efficacy. Laser surface engineering has emerged as a promising non-coating method to negate bacterial adherence. The advantages include non-contact/clean, high speed, high precision and repeatability, no microstructural changes in substrate, with negligible impact on toxicity. Our interdisciplinary research to date has (i) resulted in a research collaboration with Stryker Orthopaedics, one of the world leading biomedical implant manufacturers, and (ii) identified an impressive broad-spectrum antimicrobial/anti-biofilm effect of laser surface treated titanium alloys [3,4]. This project will further develop and characterise these extremely promising materials, focusing on the mechanism biological activity from both antimicrobial and host biocompatibility perspectives. These investigations will in turn allow for optimisation of the laser processing parameters, leading towards development of a marketable and clinically effective orthopaedic device surface.

	  Live/Dead staining of MRSA biofilm on untreated titanium. Live bacterial cells are shown in green, and dead cells in red.  Laser surface modification of titanium dramatically reduces bacterial adherence and biofilm formation. [1] Grand View Research Inc. (2016). Orthopedic Implants Market Analysis, By Application (Spinal fusion, Long bone, Foot & Ankle, Craniomaxillofacial, Joint replacement, Dental), And Segment Forecasts To 2024 (Market Research Report Code: GVR-1-68038-020-0). [2] M.A. Getzlaf, *et al.*, Multi-disciplinary Antimicrobial Strategies for Improving Orthopaedic Implants to Prevent Prosthetic Joint Infections in Hip and Knee, Journal of Orthopaedic Research, 34 (2016) 177-186. [3] Chan C.-W., Carson L., *et al.,* Enhancing the antibacterial performance of orthopaedic implant materials by fibre laser surface engineering Applied Surface Science, 404 (2017) 67-81. [4] Chan C.-W., Carson L., *et al.,* Fibre laser treatment of martensitic NiTi alloys for load-bearing implant applications: Effects of surface chemistry on inhibiting *Staphylococcus aureus* biofilm formation, Surface and Coatings Technology, 349 (2018) 488-502.
***Supervisor(s)**	Dr Louise Carson (School of Pharmacy) Dr Chi Wai Chan (School of Mechanical and Aerospace Engineering)
***Eligibility / residence Status**	
Country	Northern Ireland
***Start date and duration**	1 October 2020
***Faculty**	MHLS
***Research centre / School**	Pharmacy
Subject area	Biomaterials, Materials Science, Microbiology, Laser Engineering
Candidate requirements	Applicants should have a 1st or 2.1 honours degree (or equivalent) in a relevant subject. Relevant subjects include Pharmacy, Molecular Biology, Pharmaceutical

/ Key skills required for the post	Sciences, Biochemistry, Biological/Biomedical Sciences, Chemistry, Engineering, or a closely related discipline. Students who have a 2.2 honours degree and a Master's degree may also be considered, but the School reserves the right to shortlist for interview only those applicants who have demonstrated high academic attainment to date
***Deadline for applications**	
***How to apply / contacts**	Postgraduate Research applicants for Pharmacy who are interested in applying for a fully funded DFE studentship must have applied to Queen's, via the Direct Applications Portal, and submitted all required supporting documents by the closing date, which will be announced later in the Academic year. https://dap.qub.ac.uk/portal/user/u_login.php
Relevant links / more information	http://www.qub.ac.uk/schools/SchoolofPharmacy/Research/PostgraduatePositions/ http://www.qub.ac.uk/schools/SchoolofPharmacy/Research/
Keywords for search filters	Biomaterials, Anti-infective, Biocompatibility, Materials Science, Engineering, Orthopaedic Implant, Laser Surface Treatment
Training provided through the research project	The student will gain extensive experience in the biological screening and analysis of the interactions of biological systems (microorganisms and host cells) with laser modified surfaces. This will include microbiological assays and mammalian cell culture techniques, microscopic techniques (such as SEM, fluorescence microscopy, AFM), and biomolecular approaches. Additionally the student will develop skills and knowledge in laser technology, materials science and surface characterisation, and will also have the opportunity to gain experience in laser surface engineering of biomedical materials.
Expected impact activities	This project is based on existing collaborative research conducted between Dr. Chan and Dr. Carson that has already resulted in high quality journal publications (judged at 3* level in Pharmacy and MAE). The student will be provided with the opportunity to disseminate their work through further high quality journal outputs, and by participation at national and international conferences. Our research has attracted interest from a leading medical devices company, and collaborations with industry have been established. It is envisaged that the student will have an opportunity to engage with both industrial and academic partners. The student will be trained in a multidisciplinary environment and follow a personal development plan (PDP) that will make them highly attractive for employment in the medical device industry. Ultimately this project will further characterise and optimise this surface treatment technology, thereby increasing proximity to the development of a commercial and clinically effective medical device