***Title of studentship**	Modified silicone elastomers for reduced capsular contracture
Value / what is covered?	This PhD project is fully funded for three years, covering 100% of the UK/EU postgraduate tuition fee (currently £4,407 per annum) and a living stipend (currently £14,777 per annum). Applications from non-UK/EU nationals are also welcome, although, if successful, these applicants would have to cover the additional costs associated with the international tuition fee (currently £21,300 per annum).
Awarding body	The project is funded by an industrial partner (NuSil Technology, Carpinteria, US), a global manufacturer and supplier of specialist silicone materials.
Number of studentships	1
***Summary descriptive text / Example of research project**	Silicone gel-filled implants have been widely used for breast reconstruction and augmentation mammoplasty for more than 40 years. These implants comprise an outer thin silicone elastomer envelope that is filled with either saline or a silicone gel. The silicone elastomer envelope is made by casting a liquid addition-cure silicone elastomer mix onto a mandrel followed by thermal curing of the material. Although silicone breast implants are considered chemically and biologically inert and have been implanted in more than ten million women, there are health risks. One relatively common condition associated with breast augmentation and re-construction is 'capsular contracture'. This involves tightening of the collagen capsule that forms around the breast implant, often leading to pain and discomfort and distortion of the breast shape. Capsular contracture remains the most common cause of breast surgery revision, with reported incidence ranging from 5% to 74% of breast reconstructive surgeries. The etiology of capsular contracture is not completely understood. Fibrous encapsulation occurs at the implant site, characterized by the persistence of inflammatory cells, implant-associated foreign body giant cell formation, and excessive fibrosis. Contracture of the fibrous capsule is likely a multifactorial process and several putative culprits have been proposed, including bacterial biofilms. With time, the breast implant may degrade, and ultimately fail. There is substantial evidence showing a correlation between the presence of microbial biofilms on various medical implants and persistent inflammation of the surrounding tissue. It appears that microbial biofilms form on breast implants as well and may contribute to a chronic inflammatory response and thus formation of excessive capsular fibrosis and subsequent contracture. Recently, we have reported the unexpected and undesirable chemical binding of certain drug molecules to addition-cure silicone elastomers during preparation of controlled release drug delivery devices. The binding occurs via the same platinum-catalysed hydrosilylation reaction that is used to chemically crosslink the silicone elastomers, and invariably requires the presence of an unsaturated chemical

	functional group – such as an ethenyl, ethinyl or an enone – in the drug molecule. In this project, we will seek to exploit this hydrosilylation reaction to chemically modify the surface properties of the silicone elastomer so as to potentially reduce its tendency to capsular contracture when used in the construction of breast implants. Other strategies to reduce incidence of capsular contracture with use of silicone breast implants – including the incorporation of bioactive substances into the implant for controlled release after implantation and the physical manipulation of surface morphology – will also be considered as part of the project.
***Supervisor(s)**	The project will be supervised by three academics at the School of Pharmacy at Queen's University Belfast. Details and online profiles are provided below. Prof. Karl Malcolm (Professor of Drug Delivery) https://pure.qub.ac.uk/en/persons/karl-malcolm Dr. Peter Boyd (Senior Lecturer in Pharmaceutical Engineering) https://pure.qub.ac.uk/en/persons/peter-boyd Dr. Louise Carson (Lecturer in Pharmaceutical Science) https://pure.qub.ac.uk/en/persons/louise-carson Industrial input on the project will be provided by Benny David, Director of Business development at NuSil Technology.
Location	School of Pharmacy, Medical Biology Centre, Queen's University Belfast, Northern Ireland, UK, BT9 7BL.
***Start date and duration**	1 October 2020 Funding covers a three-year full-time PhD.
***Faculty**	MHLS
Subject area	Biomedical polymeric devices; biomaterials; drug delivery
Candidate requirements / Key skills required for the post	Applicants should have a 1st or high 2.1 (>67%) honours degree (or equivalent) in a relevant subject. Relevant subjects include Pharmacy, Pharmaceutical Sciences, Chemistry, Biomaterials Engineering, Materials Science, Microbiology 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**	31st July 2020
***How to apply / contacts**	Applications must be made online by 31st July 2020 via the Queen's University Belfast **Direct Applications Portal**; the link is provided below. As part of this process, you will be asked to submit various supporting documents, including degree certificates and English language tests (if required). https://dap.qub.ac.uk/portal/user/u_login.php

	If you need further information on the project, please email Prof. Karl Malcolm at k.malcolm@qub.ac.uk
Relevant links / more information	General information about the research activities at the School of Pharmacy, Queen's University Belfast are available at the link below: http://www.qub.ac.uk/schools/SchoolofPharmacy/Research/
Keywords for search filters	silicone elastomer; breast implant; capsular contracture; biofilm
Training provided through the research project	As part of this multidisciplinary PhD project, students will be trained in wide range of methods and techniques, including: chemistry and manufacture of silicone elastomer devices; characterisation techniques, including contact angle, NMR, FT-IR, DSC, TGA, mechanical testing, biocompatibility testing, biofilm formation; synthesis and characterisation of bioactive conjugates; in vitro biological assessment of silicone elastomers to include bacterial adherence and biofilm formation, macrophage adherence and assessment of foreign body response, fibroblast proliferation, and cytotoxicity testing.
Expected impact activities	The aim of the project is to develop new modified silicone elastomer materials with the potential to be used in the fabrication of breast implants to reduce the very significant current incidence of capsular contracture. The global breast implants market is expected to grow steadily during 2019–2023 and is on target to exceed USD 4.6 billion by 2025. Rising numbers of breast augmentation procedures coupled with increasing breast cancer incidence will further drive the market. Advances in technology and improvements in implant design and construction are likely to be a major driver of growth. Working with a leading global supplier of silicone elastomers, technology developed within the project has the potential to be at the forefront of these advances.