



School of Pharmacy PhD Projects 2014

Development of Multi-Functional Thermo-Sensitive Hydrogels for the Treatment of Bone Metastases

Dr. Helen McCarthy and Dr. Nicholas Dunne

Eligibility: Applicants should hold or expect to hold a 2.1 Hons (or equivalent) degree in a relevant discipline such as Mechanical Engineering, Biomedical Engineering, Pharmacy, Chemistry or Materials Science. It is essential that the candidate has an enthusiastic attitude towards undertaking research in the field of Healthcare Technology and is willing to travel to both academic and industrial collaborators for placements, training courses and dissemination activities.

This PhD project involves both the School of Mechanical and Aerospace Engineering and the School of Pharmacy at Queen's University Belfast. The project will also involve close collaboration with Touchlight Genetics (TLG), UK. TLG are involved in a number of international collaborations and are currently scaling up their patented processes to progress into the clinic with their doggy-bone DNA vaccines. The student will be well placed to learn about research and development in a dynamic industrial setting. The project is associated with a four year program of research between QUB and TLG and is funded under the Medical Council Research – Industrial Case PhD studentship scheme.

An aging population in the developing world has led to an increase in musculoskeletal diseases such as osteoporosis and bone metastases. Left untreated many bone diseases cause debilitating pain and in the case of cancer, death. Therefore the management of bone health is a significant part of the treatment regimen. Calcium phosphate (CaP) based powders are used clinically as the main component of injectable bone cement with bone regeneration properties that reduce SREs and CTIBL provided they can be released in the vicinity of osteoblast bone cells to exert their action. As hydrophilic compounds, CaP based powders exhibit poor bioavailability and so there is a need for improved controlled delivery options. While emerging evidence has revealed that a loss of the master tumour suppressor microRNA 34a (miR-34a) is associated with malignancies of the prostate, lung, breast, pancreas, colon, kidney, liver, bladder, skin oesophagus, brain, cervix, ovary and lymphoid.

This studentship falls directly within the MRC's remit of regeneration and replacement through the use of novel technologies in medicine to both regenerate bone cells and establish normal function by eradication of tumour cells. Within QUB, we have developed two exciting delivery technologies that include; a peptide delivery system termed RALA to condense both drugs and nucleic acids to make nanoparticles with improved delivery *in vitro* and *in vivo*, and thermo-sensitive alginate hydrogels that can be injected into bone sites as a liquid, gelate at body temperature before imbibing fluids to release the drug content over a period of time. Our industrial partner Touchlight Genetics have developed a unique platform for synthesising 'doggy-bone' nucleic acids that are more stable and effective than current plasmid systems and this will also be a key part of this proposal.

Therefore the overarching hypothesis of this novel PhD studentship is that we can develop an injectable thermo-sensitive alginate multifunctional hydrogel that incorporates both RALA/CaP and RALA/miR-34a ('doggy-bone' miR34a) releasing nanoparticles that will be functional to induce bone remodelling and also therapeutic for bone metastases.

Further information on the project can be obtained by emailing Dr Helen McCarthy (h.mccarthy@qub.ac.uk).

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Contact Details

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How to Apply

Postgraduate applications should be made using Queen's Online:

<http://pg.apply.qub.ac.uk/home/>

Please note that there are two application processes: one for admission to the university and another for postgraduate awards.

Further Information

Additional information for prospective postgraduate students can be found on the School of Pharmacy website:

<http://www.qub.ac.uk/pha>

and the Queen's Postgraduate website:

<http://www.qub.ac.uk/home/ProspectiveStudents/PostgraduateStudents/>