



# School of Pharmacy PhD Projects 2015

**Project Title** Controlled release nanocarriers for ocular delivery of therapeutic proteins

**Supervisors** Dr. Thakur R.R. Singh, Prof Ryan Donnelly and Prof. David Jones

**Description** Eye diseases, such as retinopathy of prematurity, diabetic retinopathy, age-related macular degeneration (AMD) and inherited retinal degenerations are major causes of vision loss in the UK and worldwide. For example, approximately 600,000 people in the UK suffer from vision loss due to AMD. Although there is no permanent cure for these diseases, the clinical use of therapeutic proteins (TPs) has been reported to be effective in stabilising and reducing visual impairment amongst patients. Administration of TPs by topical (eye drops), systemic (i.v) or periocular (sub-conjunctival) routes has shown little therapeutic benefit, due to multiple ocular barriers and inaccessibility of the target tissues (e.g. retina) that are located at the back of the eye. Currently, the effective method of administering TPs in the above conditions is by repeated intravitreal injections (i.e., direct injection into the eye) for every 4-8 weeks, indefinitely. Repeated injections causes significant tissue trauma, rise in intraocular pressure, uncomfortable and painful to patients, requires professional training, can cause severe injection-related infections (e.g. endophthalmitis and cataract), retinal detachment, intraocular hemorrhage, high drug-induced toxicities, and higher costs.

Our proposed solution is to formulate novel biodegradable nanocarriers encapsulating the TPs for a less-invasive intraocular administration. The nanocarriers are designed to sustain protein release for long-term and, therefore, prevent frequent injections into the eye. In this regard, during the 3-years of this PhD project, the student will (i) design, development and characterize TPs encapsulated nanocarriers, (ii) develop analytical techniques for polymer and protein analysis, (iii) investigate in vitro release of proteins from the nanocarriers, (iv) examine the biodegradation and biocompatibility of the nanocarriers, in cell-cultures and (v) conduct preliminary in vivo examinations to determine the suitability of these delivery system for human application. The student will receive sufficient training in the experimental design and techniques for the development of novel nanocarriers.

This project will also provide ample opportunity for the PhD student to gain exceptional knowledge in various aspects of pharmaceutical product development and ophthalmological techniques. It will also provide opportunity for the PhD student to present their research at national and international conferences.

September 2015

**Start Date** Ocular drug delivery, sustained release, nanocarriers, therapeutic proteins, retinal diseases, age-related macular degeneration.

**Keywords**

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#### How to Apply

Postgraduate applications should be made using Queen's Online:

<http://go.qub.ac.uk/pgapply>

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/>

