**PhD project title:** Investigating the formulation, characterization and performance of novel nanomaterials for the treatment of anaemia.

**Project funder:** The Open University, Milton Keynes.

**Key words:** Anaemia, nutrient delivery, biomaterials, iron, nanomaterials, controlled release

**Supervisors in the School of Life, Health and Chemical Sciences (LHCS), The Open University:**

Dr Nick Chatterton – Lecturer in Chemistry

**Project extended supervisory team:**

Dr Daniel Berwick – Lecturer in Health Sciences

Professor Peter Taylor – Professor of Organic Chemistry

Dr Simon Collinson – Lecturer in Chemistry

Nanofibers and nanoparticles, produced by electrospinning and electrospraying respectively, have been shown to be able to control the release of drug molecules, primarily by modifying their solubility. This project seeks to utilize this approach to tackle a major global healthcare issue by developing an effective oral therapeutic delivery system for iron to combat anaemia.

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**The Project**

Iron deficiency anaemia (IDA) is a global health problem. Soluble ferrous salts are the standard oral treatments for IDA however prolonged use can cause numerous side-effects that can lead to patient non-compliance. IDA is common in pregnant women and pregnancy induces other gastrointestinal symptoms that can exacerbate the side-effects of IDA treatment. As a consequence, the development of a newly formulated oral iron supplement with lower iron content but higher bioavailability is of importance [2].

The complimentary techniques of electrospinning and electrospraying are effective methods of generating nanofibers and nanoparticles from a wide-range of biocompatible organic polymers. These materials have numerous biomedical applications including as novel drug delivery technologies and in tissue engineering [3]. However, their application to the rational design of nutrient delivery systems is as yet relatively unexplored.

This interdisciplinary project will develop a range of nanomaterials for the potential treatment anaemia with various forms of soluble and insoluble iron, including nanoparticulate or colloidal iron, embedded within them along with other relevant bioactive compounds such as folic acid. These materials will be tailored such that the release of the active components are controlled so as to maximize bioavailability. We will also examine the degradation of the materials with time, developing an assay to monitor the release of iron with time under different conditions mimicking biological systems.

The project will involve chemical synthesis of the active iron components and fabrication of the nanomaterials...
using electrospinning/electrospraying techniques. The behaviour of nanomaterials will be studied and characterized using a wide range of techniques including scanning and transmission electron microscopy, dynamic light scattering measurements, x-ray diffraction, differential scanning calorimetry and inductively coupled mass spectrometry. Complimentary biological studies will be carried in parallel and therefore the successful applicant will also learn cell biology and biochemistry skills, such as mammalian cell culture, cell survival assays, histology and light microscopy, and potentially PCR and Western blotting. Full training will be provided in all techniques.

Project Aims:

In this project, we aim develop and test new a range of iron release nanomaterials for the use in the treatment of anaemia. This project will involve:

- The synthesis and characterization of nanoparticle, colloidal and complexed forms of iron;
- Formulation, via both electrospraying and electrospinning, of nanomaterials containing these forms of iron embedded within them;
- The characterization of these nanomaterials;
- The study of the degradation of these materials in biologically relevant media;
- Studies on the cellular uptake of iron from these materials.

Techniques:
A range of expertise and equipment will be available at The Open University (http://www.acct.open.ac.uk/science/life-health-chemical-sciences/research) Labs. The student will be required to work in the Milton Keynes campus labs.

Funding information:
This three-year research studentship is funded by the Faculty of Science, Technology, Engineering and Mathematics (STEM) at The Open University and provides a stipend of £14,553 per year (2016 rate) and all academic fees (at UK/EU level) are covered. The project is supervised by Dr Nick Chatterton at the Open University, supported by Professor Peter Taylor and Drs Simon Collinson and Daniel Berwick. You would be required to live in the UK and within commuting distance of The Open University in Milton Keynes.

References:

Requirements:
Applicants will be expected to have a degree (classification 2:1, or higher) in chemistry, pharmacy, pharmaceutical science, materials sciences, biochemistry or a relevant subject. Good numeracy, ICT, communication and organisation skills are highly desirable.

Contacts:
Informal enquiries relating to the project should be directed to Dr Nick Chatterton (nicholas.chatterton@open.ac.uk).

How to Apply:
Please send an email with your CV, a completed application form and a personal statement (outlining your suitability for the studentship, what you hope to achieve from the PhD and your research experience to date) to STEM-LHCS-admin@open.ac.uk

Vacancy ID: 10895
Closing date: 9th February 2018

Interviews will be arrange promptly after the closing date, and can be conducted via Skype if appropriate.

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