

PhD Studentship

Preventing nano- and micro- wear particles induced inflammation

People always want to be healthy and live long happy life. But unfortunately, it happens that some diseases, such as arthritis, even not being life-threatening, can affect the quality of life. One of the ways to help such people is to have artificial implants. This project will be mainly focused on implants used for knee and hip replacements.

Wear debris and osteolytic reaction that follows are one of the major failure causes in total joint replacements (TDR). Wear debris produced from articulating surfaces of implants cause aseptic loosening as a result of an inflammatory reaction of macrophages to wear particles.

Articulating surfaces of implants generate a large number of particles (macro, micro and nano sizes) as result of wear with time/age. Such released particles, so called "wear debris" cause damage bone cells (osteoclasts, osteoblasts, bone marrow). The smaller the particle the greater its surface area relative to its volume and thus the greater its physical interaction and chemical reactivity. The nano-sized wear debris particles produced from implant are thought to be the most dangerous, as they can cause DNA and chromosome damage, cytokine release and cytotoxicity in human cells [1]. One of the consequences of wear debris is inflammations in hypersensitive patients [2].

The aim of the project is to prepare orthopaedic implants eluting anti-inflammatory drugs through various mechanisms such as: mixing, infusion and surface coating of different parts of the device. Both steroidal and non-steroidal drugs will be evaluated. The following parameters and effects on the biological activity of wear particles will be considered:

- Type of drug
- Drug eluting mechanism
- Part of the device drug-impregnated
- Kinetics of drug release
- Size and chemical composition of wear debris

All testing will be carried out with nano- and micro-size particles generated both *in-vitro* and *in vivo*. The study will investigate the responses to the following cells to wear particles: osteoclasts, osteoblasts, bone marrow stromal cells and macrophages. This is an interdisciplinary project and the student will gain knowledge and experience in a wide range of techniques, such as: wet chemistry, surface and material characterisation, molecular and cell biology methods.

Informal Enquiries:

Enquiries regarding the project: Dr. Polina Prokopovich, School of Pharmacy and Pharmaceutical Sciences, Cardiff University, UK, prokopovichp@cf.ac.uk; +44 +44 (0) 29208 75820.

Requirements: Upper Second Class Honours Degree or above in Chemistry, Material Science, Colloid Science, Biomedical Science or Pharmacy.

Eligibility: The full studentship (fees and stipend) is available to UK or EU students only. The total stipend will be £13,590 per annum. Applications from other candidates with their own sources of funding are welcomed. Outstanding students will be eligible for the award of a prestigious President's Scholarship.

<http://www.cf.ac.uk/presidents/>

Apply on line to Dr. Polina Prokopovich, School of Pharmacy and Pharmaceutical Sciences:

<http://www.cardiff.ac.uk/regis/general/applyonline/index.html>

Deadline of applications -15 May 2014.