THE UNIVERSITY OF SYDNEY

Nanoparticle-Based Biomolecule Detection Systems Research Scholarship

Over 6,000 genes in the human genome encode surface proteins and yet we only have antibodies capable of detecting a small number of these surface proteins. This project will focus on the development of a novel nanoparticle biomolecular detection system.

Join a multi-disciplinary lab with expertise in biology, bioengineering, applied physics and materials science, and have access to the world class research facilities in the Charles Perkins Centre, the Sydney Nano Institute and the Australian Centre for Microscopy and Microanalysis

The Project:

The human genome contains over 6,000 genes encoding surface proteins including a broad range of receptors, transporters and channels that we currently cannot detect due to a lack of antibodies. This project will develop novel methods to detect protein expression by different cell types, with the goal of improving our understanding of cellular differentiation pathways. This is a multidisciplinary project bringing together nanoparticle technology with flow cytometry and cellular imaging.

This multidisciplinary project aims to improve our understanding of cellular differentiation, in particular the differentiation of blood cells, using flow cytometry and imaging with a novel nanoparticle-based detection system. This system could readily be adapted to improve current diagnostic systems. The knowledge generated can ultimately be used to improve diagnosis, assist in improving health outcomes and expanding our understanding of cellular signaling and differentiation.

Project's Mission:

Improve cellular molecular detection using nanoparticles with the ultimate goal of generating novel diagnostic and research technologies.

Other Information:

The project is part of an existing collaboration between medical scientists from the School of Medical Sciences, Faculty of Medicine and Health with plasma physicists and materials scientist from the Schools of Physics and Biomedical Engineering. In this context, students working on it will develop the skills required to communicate and work successfully as part of a multidisciplinary team. Mentoring from across all of these fields will be provided.

The project presents opportunities to learn and utilize a wide range of techniques including plasma reactor generation of nanoparticles, attenuated total internal reflection Fourier transform infrared spectroscopy (ATR-FTIR); X-ray photoelectron spectroscopy (XPS); scanning electron microscopy (SEM); electron paramagnetic resonance (EPR) spectroscopy; tensiometry for surface energy analysis; dynamic light scattering (DLS) nanoparticle sizer; zeta potential measurement; microplate readers; fluorescence microscopy; ultracentrifuges; flow cytometry; live cell imaging; surface plasmon resonance (SPR).

Biochemical and biomedical techniques include fluorescence and confocal microscopy, flow cytometry and cell culture. Through collaboration with plasma physicists, the project will also provide exposure to a variety of plasma processes for materials modification and advanced plasma diagnostic equipment, including fast CCD camera, high resolution gated optical emission spectroscopy (OES), ion energy analysers and Langmuir probes. Theoretical studies will utilize finite element codes such as COMSOL or ANSYS.

The student should have a background in Medical Science, Science, Biomedical Engineering, Physics, Engineering, Materials Science, Nanotechnology or a related discipline that includes experience in fundamental laboratory experimental techniques, clean room work and/or general fabrication work and good written and verbal communication skills. Experience in Physics or Engineering or related discipline is highly desirable.

For further information on the research area, please contact:

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