Faculty of Engineering
Summer Research Program 2020-2021

Project Title: Development of nanoparticle-based sensors for monitoring hypoxia in biological systems.

Supervisor(s): Dr Simon Corrie
Department: Chemical Engineering
Email: simon.corrie@monash.edu
Website profile of project supervisor: www.nanosensor-eng.net

Objective

Evaluate oxygen-responsive nanosensors in bacterial and mammalian cell cultures

Project Details

Many important disease processes are characterised by dynamic changes in local oxygen concentration, including cancer, cardiovascular disease and inflammation caused by a range of stimuli. The technology surrounding the measurement of oxygen and reactive oxygen species generally involves the use of oxygen-sensitive dyes, whereby the intensity of the dye is quenched in high-oxygen environments. However, these dyes are not photostable, and they diffuse away from the site of interest, so they cannot be used for long-term or real-time imaging. We have synthesised and validated silica-based oxygen nanosensors, and we now need to validate these sensors in a range of simple biological environments (e.g. batch bacterial or mammalian cell cultures).

In the Nanosensor Engineering Lab, we are developing nanoparticle-based sensors for a range of biosensing projects, with the ultimate aim of monitoring specific disease biomarkers inside living organisms in a continuous, real-time manner. One aspect of our work involves developing the nanosensors themselves, while the other aspect involves developing the various bioimaging modalities (fluorescence, ultrasound, and photoacoustic imaging) that can be used to detect the signals emitted from the nanomaterials from deep inside complicated biological systems (e.g. cell cultures, live animals, etc).

Additional Information

Shortlisted students will be required to attend an interview.

In this Project, students will spend the majority of their time testing the nanosensors in bacterial or mammalian cell cultures, using a range of tools in our lab (e.g. microscopy, antibodies, nanoparticles and combinations thereof), and will work in an interdisciplinary team on a milestone-based program. Students with a background in engineering, with additional training in science and/or experience in lab work are encouraged to apply.