Hamilton Undergraduate Scholarship Programme 2010
PROJECT NO. 5

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Project Title: Novel Electrochemiluminescent sensors based nanoparticle development

Duration of Project **From:** 7 June 2010 **To:** 13 August 2010

Project Description:

This research addresses how single molecules such as quantum dots or metal centres within nano-structured platforms can be used to create efficient electrochemiluminescent (ECL) sensors, specifically for biomedical sensors with ultra-high sensitivities and selectivity's. The unique capabilities of these novel nano-materials will arise from the coupling of photonic, chemical, optical and fouling resistant properties of each component to create a sensitive and selective detection system while allowing for applications in point of care devices.

ECL is a process by which luminescence is produced from an electrochemical reaction has gained popularity as a detection technique in medical diagnostics. ECL is a highly selective and sensitive process initiated by applying a suitable potential to an electrode surface on which electron transfer occurs between an electrochemically generated species, often tris(2,2'-bipyridine)ruthenium and a co-reactant such as hydrogen peroxide, resulting in the production of light. The ability to accurately control the potential at the electrode surface allows for dictation of the electrochemical reaction kinetics, advantageous for manipulating the time and position of the signal produced. ECL is also compatible with solution-phase and thin-film formats and no external light source is required, which reduces the background optical noise and the cost in equipment.

These studies focus on the development of the nanoparticles, which will impart desirable photophysical and electro-chemistries at the material-solution interface to optimise the sensitivity and selectivity of its ECL production for applications in sensor technologies.

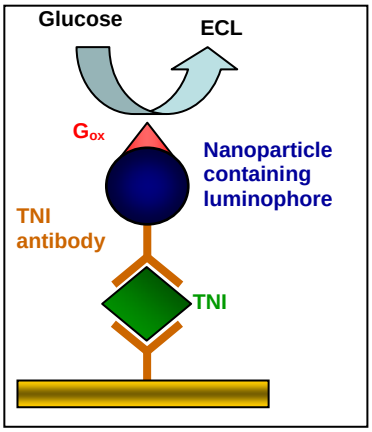

Figure 1: ECL schematic

These materials will feed into the development of ECL sensor designs, novel detection platforms and easy to use devices. This research aims to advance the development of nanomaterials for the detection of biologically significant biomarkers. The properties of these materials will uniquely enable the development of advanced diagnostic devices based on the luminescent detection of biomarkers at sufficiently low concentrations so as to change clinical practice.