***Dept. Chemistry - Teaching Fellowship PhD project: Physical/Analytical area***

**Project title: Conducting polymer – molecular recognition agents for electrochemical sensing of sialic acids involved in human disease.**

*Key chemical techniques/skill set: electrochemical analysis, conducting polymers, nanomaterial preparation and characterisation, electrochemical impedance spectroscopy, printed sensor design and fabrication.*

Abstract:

Glycans or complex carbohydrates are involved in many pathological and physiological processes including immune response and viral infection with roles in molecular recognition and cell signalling. Viral cell wall glycoproteins bind to terminal sialic acid (SA) groups (Fig. 1) in the initial stage of viral infections. The most important SA is N-acetylneuraminic acid, which mainly occurs as the terminal sugar of glycoproteins or glycolipids distributed on cell membranes. The level of SA in blood serum has also been reported to correlate with various disease states including cancer. Therefore, measurement of SA is significant in relation to clinical diagnostics. Immobilised chemoreceptors such as boronic acids (e.g. 3-aminophenylboronic acid APBA) can form covalent interactions with diol bearing compounds. Selectivity is related to the formation of intermolecular B−N or B−O bonds between the boron atom and the amide group of SA at the C-5 position. A key aim of the project is design and fabrication smart recognition materials confined on an electrochemical transducer suitable for rapid and reliable testing which will aid understanding of the role sialic acids play in relation to the immune system and protection from disease. Conductive polymers (e.g. poly(3,4-ethylenedioxythiophene, polyaniline) have attractive and unique properties that make them suitable for electrochemical sensor applications. With the aid of these materials, we will generate nanocomposites of APBA with functionalised graphene or other 2D materials realising surface confined chemoreceptors. This will enable binding and selectivity data to be generated for the model compound sialic acid (5,N-acetyl-D-neuraminic acid). The nanoprobe can also provide large surface area for loading of redox reporting molecules (e.g. phenothiazine redox dyes), aiding sensitive signalling and detection.



*Fig. 1 General chemical structure of sialic acids.*

Scholarship details: Maximum 360 hours teaching support duties in the course of a year. Salary €9007 + €1000 PRSI, pension.  PGs may undertake additional max 120 hours outside teaching year (as Graduate Teaching Assistants (GTA)).

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