68th Irish Universities Chemistry Research Colloquium

Applications of Fluorescent Biosensors for Non-Invasive Glucose Monitoring

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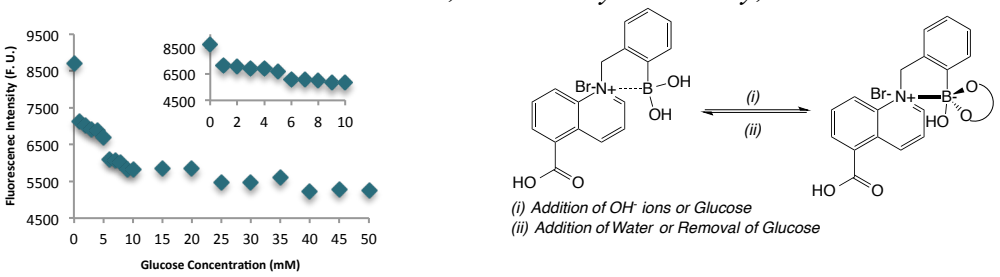

Figure 1: Direct glucose sensing using a fluorescent boronic acid derivative.

Abstract:

Diabetes is a widespread disease, whereby the body is incapable of regulating the metabolism of glucose[1]. As a result, this disorder leads to severe health effects such as blindness, kidney failure and stroke[1-2], where monitoring glucose has proven to prevent some of these undesired side effects. Current monitoring methods for diabetes are either invasive or non-continuous, where Brooks et al have introduced contact lenses, on the cover of ACS Nanomaterials, as a sensing platform for noninvasive monitoring[1]. This highlights the need for a non-invasive, continuous glucose-monitoring device for personal use[1].

Lewis acidic boronic acids (BAs) are widely known for their strong but reversible interactions with diol-containing compounds like glucose[1]. This phenomenon has lead to the development and evolution of many fluorescent boronic acid derivatives, where the BA-sugar interaction can be monitored by changes in fluorescence[1]. In our group, a range of boronic acid derivatives have been developed and investigated for their direct or indirect glucose sensing capabilities, at physiological pH. When the BA moiety is directly attached to a fluorescent component, the fluorescence of these BA-derivatives becomes quenched in the presence of glucose (**Figure 1**). The second type of fluorescence change is observed upon integration of the BA moiety and fluorophore in to a two-component system. In these sensors the presence of the BA results in a decrease of fluorescence, which can be restored in the presence of glucose[2]. This project aims to incorporate BA derivatives on to flexible polymeric substrates for continuous non-invasive glucose sensing in wearable devices, such as sensing patches or smart contact lenses.

References:

1 Brooks, W. L. A. and Sumerlin, B. S. *Chem. Reviews*, 2016, 116, 1375-1397.
2 Yao, H.; Shum, A.J.; Cowan, M; Lanhdesmaki, I and Parviz, B.A. *Biosensors and Bioelecrtronics,* 2011, 26, 3290-3296.

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