Structure-switching DNA on graphene oxides based *in vivo* device for continuous monitoring of interferon-γ in inflammatory mice

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Cytokine are cell signalling molecules in our immune systems. The dynamic secretion of cytokines makes continuous monitoring of cytokines especially essential for the understanding of chemistry behind the biology of living organisms.[1] Structure-switching DNA molecular machine, recognised with the 2016 Nobel Prize for Chemistry, has demonstrated great success in the continuous monitoring of small molecules in blood serum.[2] Cytokine sensing is challenging due to their typically low abundances in physiological conditions. Nanomaterials fabricated interfaces demonstrated unique advantages in ultrasensitive sensing.[3] Graphene oxide (GO), with its exceptional physical and chemical properties and biocompatibility, holds a tremendous potential for sensing applications. In this study, GO, acting both as the electron transfer bridge and the signal reporter, was attached on the interface to develop an amperometric sensing device based on structure-switching aptamers for long-term detection of cytokines in a living organism. The device incorporates a single layer of GO acting as a signal amplifier on glassy carbon electrodes. The hairpin aptamers specific to interferon-γ (IFN-γ), which were loaded with redox probes, are covalently attached to GO to serve as bio-recognition moieties. IFN-γ was able to trigger the configuration change of aptamers while releasing the trapped redox probes to introduce the electrochemical signal. This *in vivo* device was capable to quantitatively and dynamically detect IFN-γ down to 1.3 pg mL^{-1} secreted by immune cells in cell culture medium with no baseline drift even at high concentration of other nonspecific proteins. The biocompatible devices were also implanted into subcutaneous tissue of enteritis mice, where they performed precise detection of IFN-γ over 48 hours without using physical barriers or active drift correction algorithms. Moreover, the device could be reused even after multiple rounds of regeneration of the sensing interface.

References:

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