Real-time detection of viral surface antigens using hybrid graphene-gold Nanosensors

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Point-of-care (POC) diagnostics for disease detection are fast, cheap & easy to use in comparison to laboratory tests, requiring highly trained staff, large/expensive equipment & long time-to-result[1]. There has been rapid growth of POC diagnostics in recent years with increasing emphasis on resource-limited settings[2], particularly relevant to diagnosis of hepatitis - a major global health problem affecting almost 400 million people worldwide[3]. A nanosensor based on a graphene resistor functionalized with AuNPs (Gold Nanoparticles) is demonstrated for the real-time detection of hepatitis B surface antigen (HBsAg). Graphene–AuNP hybrid structures are of particular interest in sensing applications because they display individual properties of graphene and AuNPs, but can also exhibit additional synergistic properties[4]. Real-time 2-point resistance measurements, performed using varying concentrations of hepatitis B surface antigen (HBsAg), show a linear dependence of resistance change against the logarithm of HBsAg concentration (log[HBsAg]). A limit of detection of 50 pg/ml was observed[5]. Moreover, the hybrid biosensor platform has potential to be applied to other viral proteins or any biomarker of interest.

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FIGURES

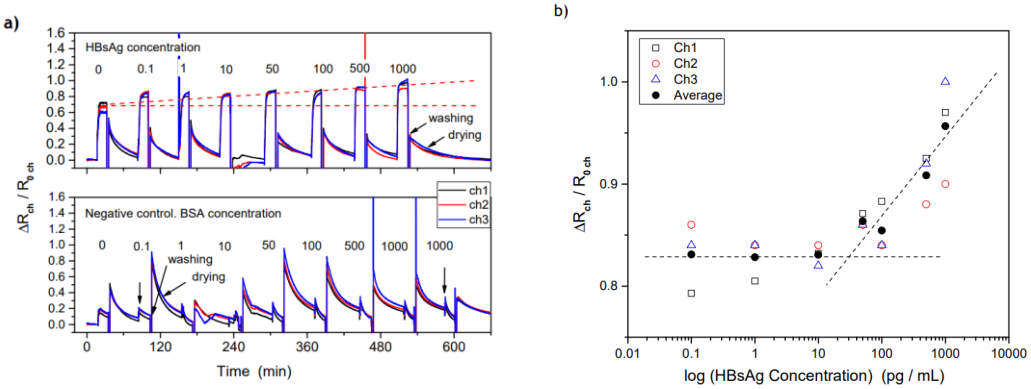

Figure 1: a) Graphene channel resistance response to the time- dependent application of HBsAg concentrations in pg/ml (top) and at various BSA concentrations in pg/ml (bottom). Where $\Delta R = R_{channel} - R_{0\ channel}$, and $R_{0\ channel}$ is the initial resistance measurement. b) Normalized graphene channel resistance against log HBsAg concentration.

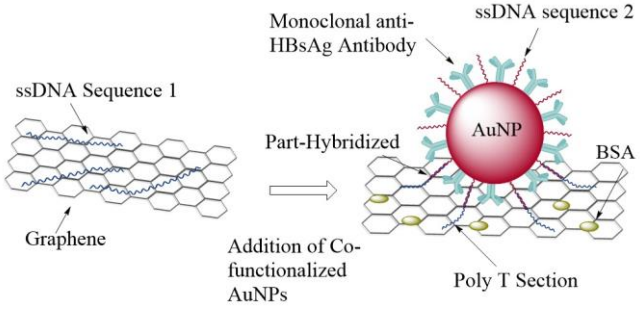

Figure 2: Graphene-AuNP hybrid manufacture through part-hybridization of ssDNA sequences.