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J Nanomed Nanotechnol 2018, Volume 9
DOI: 10.4172/2157-7439-C7-086

Confined nanoscale geometries to enhance sensitivity of plasmonic immunoassays

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Sensitive transduction of bio-molecular binding events on chip carries profound implications to the outcome of a range of biological sensors. This includes biosensors that address both research as well as diagnostic questions of clinical relevance, e.g. profiling of biomarkers, protein expression analysis, drug or toxicity screening and drug-efficacy monitoring. Nanostructured biosensors constitute a promising advance in this direction owing to their ability in catering to better sensitivity, response times and miniaturization. Plasmonic sensors are particularly interesting among nanobiosensors as they exploit light matter interactions in the nanoscale to transduce bio-recognition events with high sensitivity and miniaturized measurement footprints. Examples of plasmonic sensors include Localized Surface Plasmon Resonance Spectroscopy (LSPR), Surface Enhanced Raman Spectroscopy (SERS) and Metal-Enhanced Fluorescence (MEF). The performance of the plasmonic sensors critically relies on ability to engineer nanoscale geometric attributes at length scales that typically overlap with the size of small proteins. Such geometries invariably introduce constraints on the molecular binding response, thus altering the interaction outcomes, viz. density and kinetics of adsorption, molecular orientations in a manner that would impact the resulting optical response. A careful engineering of the nanoscale geometries can simultaneously take advantage of EM field enhancements together with molecular interaction within nanoscale geometries. To this end, this project aims at an engineered nanoscale interface with geometry tailored to simultaneously favor molecular adsorption and plasmonic enhancements for application to plasmonic sensors based on surface-enhanced Raman and fluorescence spectroscopies.

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