Biofunctional Surfaces for Multiplexed Diagnostic Platforms using Site-Encoded DNA Strategies

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Advances in genomics and proteomics, point to a future in which clinical diagnostic will be based on molecular signatures characteristic of the health/disease status of the individuals, for which simultaneous detection of multiple biomarkers will be required. Moreover, future trends in medicine demand for rapid, reliable diagnostic technologies able to assist doctors on a more personalized and efficient medicine. In this respect, research in micro/nanobiotechnologies may allow the development of a new generation of improved diagnostic devices based on novel biosensing systems. Biosensors are devices responding to biomolecular recognition events occurring at the surfaces of particular micro/nanostructured materials, known as transductors, which defined physical properties are influenced by those specific events. To achieve this goal there is the need to construct homogeneous, organized, biocompatible and stable functional biohybrid surfaces in which the bioreceptor and the material behave as a single unit. However, preparation of reliable bioreceptor protein multiplexed platforms is still a challenge due to the molecular variability and complex nature of proteins (different hydrophobicities, acidic or basic characters, functionality, etc.). Thus, development of protein microarray technology has not been as straightforward as the DNA microarray technology. Unlike nucleic acids, which are relatively homogeneous in terms of structural and electrostatic properties, proteins can be extremely diverse regarding chemical structure and biological properties. Preventing protein denaturation and maintaining structural conformations and biofunctionality, while constructing these biohybrid surfaces that will act as transductors, are key issues. An alternative to circumvent these limitations is the use of oligonucleotide probes with well-known sequences and their subsequent hybridization with their complementary oligonucleotides previously immobilized on the surface. Examples on the use of this strategy, known as DNA-Directed Immobilization (DDI), to develop fluorescence site-encoded DNA addressable microarrays and biosensors platforms based on distinct principles will be presented.

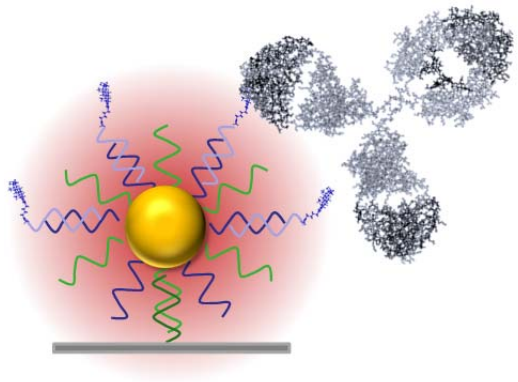

Figure 1. DDI schematic approach of a LSPR immunosensor chip