

## FUNCTIONALIZED NANOPARTICLES FOR HIGHLY SENSITIVE OPTICAL DETECTION OF CANCER BIOMARKERS IN BLOOD PLASMA SAMPLES

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### Abstract

In the last two decades functionalized gold nanoparticles (AuNPs) have been widely used in optical affinity biosensors for the detection of molecules at low concentrations. Typically, functionalized AuNPs are applied in the last step of the sandwich assay after the target molecules have been captured on the surface of a biosensor chip. This approach allows an increase in the sensitivity of biosensors by several orders of magnitude. Despite this immense potential of functionalized AuNPs, however, experimentally observed enhancements are often lower.

In this contribution we will present and discuss the use of functionalized AuNPs with a surface plasmon resonance (SPR) biosensor for the detection of cancer biomarker carcinoembryonic antigen (CEA). We have established a sandwich assay using AuNPs functionalized with proteins such as antibodies or streptavidin molecules. Specifically, we will discuss how a variety of the experimental aspects affect the enhancement of the SPR signal, including the size of the AuNPs, the detection assay, and the surface functionalization of the AuNPs. Finally, we will demonstrate that for an optimized experimental arrangement we were able to detect CEA marker in 50 % human blood plasma samples at levels as low as 100 pg/mL, which is well below the physiological level of CEA.

**Keywords:** Functionalized gold nanoparticles, cancer marker, blood plasma, surface plasmon resonance biosensor

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