Detecting Early Stage Metastatic Breast Cancer: A Novel Approach to the Engineering of a Gold Nanorod Based Point-of-Care Biosensor

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This research project details the development and implementation of a novel biosensor utilizing gold nanorods for the early stage detection of HER2-mediated breast cancer. Aspect ratio dependence of LSPR provides an ideal mechanism for detecting cancers at earlier stages. GNRs of select sizes can be utilized to ensure distinct plasmon peaks in absorption spectrums. Monitoring the spectral shift at the dedicated peaks allows for detection of the specific analyte. Here, the unique properties of GNR's biosensing capability was applied to produce a cost and time-effective, portable biosensor for early stage detection of HER2-mediated breast cancer. Specifically, nanorods of 990nm and 940nm were assembled onto thiol-terminated substrates, followed by functionalization of the anti-HER2 in order to construct a highly sensitive GNR biosensor. As a model system, concentrations of HER2 were measured by correlating redshifts at distinct resonance peaks caused by specific target binding. Calibration curves exhibited a linear relationship between spectral shifts and analyte amount. The sensing performance in the double-GNR system was a drastic improvement when compared to the single-GNR system. Coupled with a portable spectrophotometer, this biosensor has potential for increased early detection rates in women of lower socioeconomic status and those in developing countries who do not have access to screening centers. This can significantly lower the rate of breast cancer fatalities for women who do not have the financial means to pay for other detection methods. Upon analysis, the utilization of this novel biosensor opens the door for a new paradigm of development in the era of nanobiosensing.

Awards Won:

Third Award of $1,000