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Combined SERS biotags (SBTs) and microfluidic platform for the quantitative ratiometric discrimination between noncancerous and cancerous cells in flow

Proc. SPIE 8460, Biosensing and Nanomedicine V, 84600T (October 10, 2012); doi:10.1117/12.930405

From Conference Volume 8460

Biosensing and Nanomedicine V
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San Diego, California, USA | August 12, 2012

abstract

SERS biotags are made from polymer-encapsulated silver nanoparticle dimers infused with unique Raman reporter molecules, and carry peptides as cell recognition moieties. We demonstrate their potential use for early and rapid identification of malignant cells, a central goal in cancer research. SERS biotags (SBTs) can be routinely synthesized and simultaneously excited with a single, low intensity laser source, making the determination of the relative contribution of the individual SBTs to the overall spectrum tractable. Importantly for biomedical applications, SERS employs tissuepenetrating lasers in the red to near-infrared range resulting in low autofluorescence. We have previously described a multiplexed, ratiometric method that can confidently distinguish between cancerous and noncancerous epithelial prostate cells in vitro based on receptor overexpression. Here we present the progress towards the application of this quantitative methodology for the identification of cancer cells in a microfluidic flow-focusing device. Beads are used as cell mimics to characterize the devices. Cells (and beads) are simultaneously incubated with two sets of SBTs while in suspension (simulating cells' capture from blood), then injected into the device for laser interrogation under flow. Each cell event is characterized by a composite Raman spectrum, deconvoluted into its single components to ultimately determine their relative contribution. We show that using SBTs ratiometrically can provide cell identification insensitive to

normal causes of uncertainty in optical measurements such as variations in focal plane, cell concentration, autofluorescence, and turbidity.

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