

Surface immobilization of antibodies and nucleic acid arrays on waveguide optical sensors

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INTRODUCTION: All bioanalytical assays using surface-capture of target analytes suffer from non-ideal sensitivity and selectivity. We have recently focused on microarray formats on optical waveguide surfaces to improve assay performance. Thiol-terminated DNA probe oligonucleotides exhibited substantially higher surface printing immobilization and target hybridization efficiencies than non-thiolated DNA probe oligonucleotides: strong fluorescence signals from target DNA hybridization supported successful DNA oligonucleotide probe microarray fabrication and specific capture bioactivity. Analogously printed arrays of thiolated streptavidin and non-thiolated streptavidin did not exhibit noticeable differences in either surface immobilization or analyte capture assay signals.

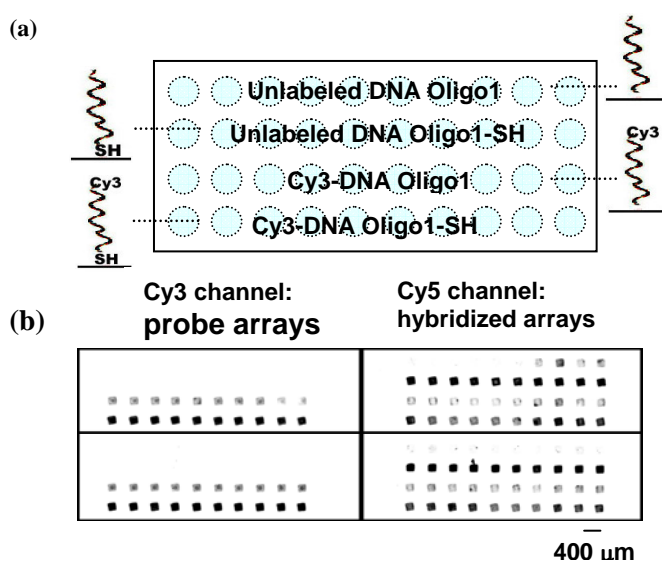
METHODS: Sputtered silicon nitride optical waveguide surfaces were silanized and modified with a hetero-bifunctional crosslinker¹ to facilitate thiol-reactive immobilization of contact-printed DNA probe oligonucleotides, streptavidin and murine anti-human interleukin-1 β capture agents in microarray formats. X-ray photoelectron spectroscopy (XPS) was used to characterize each reaction sequence on the native silicon oxynitride surface.

Fig.1. Microarray DNA print and target hybridization fluorescent signals on maleimide-activated surfaces: (a) microarray experimental lay-out; (b) actual fluorescence scanned images (upper/lower = 2 identical arrays) for printed DNA probes formatted as in (a), and hybridized with Cy5-DNAoligo2 targets Relative allocation and amount of resources in research.

DISCUSSION & CONCLUSIONS: Probe DNA oligonucleotides bearing terminal thiol end groups exhibited significantly improved printing efficiency over non-thiolated analogous oligonucleotides using thiol-maleimide surface coupling. This led to improved hybridization performance in surface-capture assays with complementary DNA target solutions. However, significant target hybridization from non-specific binding of printed non-thiolated oligonucleotide probes was also observed. Printed streptavidin and anti-human IL-1 β capture proteins showed little difference in surface retention between covalent and non-covalent attachment modes, demonstrating the fundamental differences between DNA oligomer and protein printing influences on array bioactivity, and the importance of producing surface chemistries that might exploit these differences to improve protein-based microarray assays.

REFERENCES: ¹ A. Rezanian, R. Johnson, A.R. Lefkow, K.E. Healy, (1999) *Langmuir* **15**: 6931-6939.

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RESULTS: