

## SPR Imaging Measurements of DNA and Antibody Microarrays Created from Microfluidic Channels on Gold Thin Films

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Surface plasmon resonance (SPR) imaging is a surface-sensitive optical technique that detects the affinity binding of unlabeled biological molecules onto arrays of molecules attached to chemically modified gold surfaces. We have recently demonstrated that SPR imaging measurements of DNA microarrays fabricated on gold surfaces can be used to monitor DNA-DNA, RNA-DNA, and protein-DNA interactions down to nanomolar concentrations.[1] In those initial sets of measurements, the DNA microarrays consisted of 500  $\mu\text{m}$  squares with a total sample volume of approximately 500  $\mu\text{L}$ . For biological applications such as gene expression and the detection of microbial species, it would be preferable to use a significantly smaller sample volume. One way to achieve this is to employ microfluidic networks.

In a recent paper [2], microfluidic channels fabricated from polydimethylsiloxane (PDMS) are employed in surface plasmon resonance (SPR) imaging experiments for the detection of DNA and RNA adsorption onto chemically modified gold surfaces. The PDMS microchannels are used to: (i) fabricate "1-D single stranded DNA (ssDNA) line arrays" that are used in SPR imaging experiments of oligonucleotide hybridization adsorption, and (ii) create "2-D DNA hybridization arrays" in which a second set of PDMS microchannels are placed perpendicular to a 1-D line array in order to deliver target oligonucleotide solutions. In the 1-D line array experiments, the total sample volume is 500  $\mu\text{L}$ ; in the 2-D DNA array experiments this volume is reduced to 1  $\mu\text{L}$ . As a demonstration of the utility of these microfluidic arrays, a 2-D DNA array was used to detect a 20 femtomole sample of *in vitro* transcribed RNA from a partial clone of the *uidA* gene from a transgenic *Arabidopsis thaliana* plant. Preliminary experiments of SPR imaging measurements of antibody arrays will also be presented.

### References

1. Bryce P. Nelson, Timothy E. Grimsrud, Mark R. Liles, Robert M. Goodman, and Robert M. Corn, *Analytical Chemistry*, **73** 1-7 (2001).
2. Hye Jin Lee, Terry T. Goodrich and Robert M. Corn, *Analytical Chemistry*, **73** 5525-5531 (2001).