STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

Thursday March 27, 2008
Carnegie Room 315, Time: NOON

High-Throughput Microfluidic Platforms: Expanding the Capabilities of Surface Plasmon Resonance (SPR) and Other Biosensor Technologies

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Microfluidic devices play a significant role in the performance of SPR and other evanescent wave technologies. Microfluidic delivery of biomolecules to miniature regions on a biosensor surface reduces sample consumption while enhancing mass transport. Traditional SPR has been limited primarily to serial sample analysis, based on 2-D microfluidic flow cells. SPR Imaging provides the opportunity for parallel sample analysis; however, conventional 2-D microfluidic flow cells do not utilize the sensor surface efficiently. A 3-D microfluidic flow cell array (MFCA) has been developed which enables 48 isolated, immobilization zones on an SPR sensor chip. Offline microfluidic printing of protein microarrays significantly outperforms traditional pin-spotting on standard Biacore capture surfaces while printing from dilute sample (<1 ug/ml). Direct integration of the MFCA with an SPR biosensor has also been achieved, enabling real-time detection of 48 separate reaction zones. Scaling to 96, 192, 384, etc. is also possible due to the microfluidic configuration and fabrication process. Results from the fabrication process, offline and in situ performance, and computational fluid modeling (CFD) will be discussed.

Mark A. Eddings is a PhD Candidate in the Department of Bioengineering at the University of Utah. He also received his undergraduate degree in Mechanical Engineering from the University of Utah in 2004. While working on his undergraduate degree, he worked as an Engineering Intern for Medron, a medical device manufacturing company, specializing in percutaneous catheters and other related devices. He has been an NSF IGERT fellow, a research assistant for the Utah State Center of Excellence for Biomedical Microfluidics, and is currently working as a Biomedical Engineer for Wasatch Microfluidics. His research interests focus on developing microfluidic solutions to solve biological problems. Previous research has focused on clinical applications of microfluidic immunoassays for therapeutic monitoring and point-of-care diagnosis. Other research consisted of micropump development for lab-on-a-chip applications and developing a microfabrication process for microneedle arrays.

For more information, please contact Prof. Frank Fisher at Frank.Fisher@stevens.edu or 201-216-8913