STEVENS Institute of Technology

STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

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Carnegie Room 315, Time 1:30 pm

MEMS and Microfluidic Systems for Biomolecular Manipulation and Characterization

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Microelectromechanical systems (MEMS) and microfluidics technologies hold potential to vitally impact biology and medicine. Our research group has been pursuing MEMS and micro/nanofluidic systems as innovative tools for biological manipulation and characterization, with a primary interest in controlling the motion and measuring the dynamic behavior, such as conformational transitions, interactions, and reactions, of biomolecules in solution. Such miniaturized systems will allow biomolecules to be interrogated in controlled micro/nano environments with orders-of-magnitude reduction in the consumption of biological material. Functional and structural integration will allow multi-mode analysis of complex biomolecular processes with improved sensitivity, reliability and automation. Arrays of devices integrated in a single system will afford parallelized, high-throughput processing of samples. Ultimately, such systems will enable novel biomolecular investigations that are unattainable with conventional technologies.

This presentation will give a highlight of our efforts in designing and creating such MEMS and micro/nanofluidic systems. We pursue manipulation of biomolecular solution by exploiting polymers as micro/nanofluidic functional materials. For example, highly compliant microstructures of elastomeric polymers have been used as passive flow control devices, while surface-grafted, thermally responsive polymer nanolayers are being exploited to enable active, intelligent biofluid handling and chromatographic separations. We address biomolecular characterization with microsystems that integrate MEMS sensors with microfluidics. These include integrated calorimetric devices for measuring metabolic reactions as well as conformational changes and interactions of DNA and proteins, and integrated vibrational sensors for detecting hydrodynamic property changes induced by biomolecular events. We will present experimental results from prototype devices, as well as models that afford in-depth understanding of the device physics.

DR. QIAO LIN is an Associate Professor in the Mechanical Engineering Department at Columbia University. He received his Ph.D. degree in Mechanical Engineering from Caltech in 1998, where he conducted thesis research on optimal planning of robotic manipulation. He was a postdoctoral scholar in Caltech's Electrical Engineering Department from 1998 to 2000, where he pursued research in microelectromechanical systems (MEMS) and investigated silicon-micromachined fluidic and thermal devices. From 2000 to 2005, he was an Assistant Professor of Mechanical Engineering at Carnegie Mellon University. Dr. Lin's research addresses the design, analysis and fabrication of MEMS and micro/nanofluidic systems for manipulation and characterization of biomolecules and their solutions.

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