The 43rd JUACEP Seminar

第 43 回 名古屋大学日米協働教育プログラムセミナー

10:30- Friday, June 30, 2017
Lecture room 221（2F, Eng.Bldg. II）

Electrokinetic and Nanomechanical Transport of Biomolecules for Ultrasensitive Bio-Detection

Prof. Katsuo Kurabayashi
Associate Chair
Department of Mechanical Engineering
Department of Electrical Engineering
and Computer Science
University of Michigan, U.S.A.

Abstract

On-chip high-throughput, ultrasensitive screening for emerging diagnostic applications and innovative scientific discovery require systems for detecting protein concentrations in the nano- to picomolar range (~ a few molecules per cell). Low volume technology is expected to promise sensitivity, cost, and speed advantages associated with small scales. However, such small scales pose crucial challenges to bio-detection owing to friction against fluid transport at low Reynolds numbers and random motion of molecules. These challenges significantly compromise on-chip nano-biosensors. To address these issues, we have developed integrated microsystems that control mass transport of biomolecules under micro- to nanofluidic environments with AC electroosmosis flow and adenosine triphosphate (ATP)-fueled motor proteins. Our system integrates AC electroosmosis flow-inducing microelectrodes with plasmonic nanoparticle biosensors. Another system implements nanoscale mechanical manipulation of the stochastic motion of motor proteins for protein concentration. Motor proteins are nanometer-scale biomaterials that convert chemical energy stored in ATP into mechanical work. This seminar talk discusses fundamental statistical mechanics, electrodydrodynamics, and mass transport theories, nanomaterial synthesis, and microfabrication that provide the foundations of our technological approaches and their impacts on clinical diagnosis of immune diseases. (Talked in English)

Biography

Katsuo Kurabayashi is Professor of Mechanical Engineering and Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor. He received his BS in Precision Engineering from the University of Tokyo in 1992, and his MS and PhD in Materials Science and Engineering from Stanford University, CA, in 1994 and 1998, respectively. His current research focuses on optofluidics, nanoplasmonic and biomolecular biosensing, and BioMEMS/microsystems for immunology, clinical diagnosis, and analytical chemistry. He received the 2001 NSF Early Faculty Career Development (CAREER) Award, and the Robert Caddell Memorial Award in 2005, the Pi Tau Sigma Outstanding Professor Award in 2007, the Mechanical Engineering Outstanding Achievement Award in 2013 from the University of Michigan, and the Ted Kennedy Family Team Excellence Award in 2015 from the College of Engineering at the University of Michigan.

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