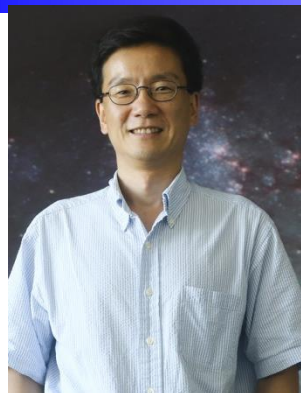




### BioSyM Seminar Series 2014



## Prof. Yong-Ak (Rafael) Song

Assistant Professor

New York University Abu Dhabi

*Present:*

## New Microchip Technologies for Manipulation of Biomolecules and Ions in Bioengineering

### ABSTRACT

Micro- and Nanotechnology open up new exciting possibilities to manipulate biological entities and measure biological signals at such unprecedented precision that we can gain deeper insights into the complex biological processes and find new approaches to solve biological and biomedical problems. In this talk, I will present new microchip technologies for manipulation of ions and biomolecules in bioengineering. In the first part of my talk, a high-throughput separation chip for proteins and peptides based on the free-flow zone electrophoresis will be presented. Using this microchip with a tunable membrane, a complex mixture of proteins and peptides can be separated into several less complex fractions at a flow rate of  $1\mu\text{L}/\text{min}$  and coupled to mass spectrometry (MS) for detection. In the second part, I will talk about our recent efforts to couple an electrokinetic concentrator to a morpholino-based DNA sensor. DNA microarrays have allowed conducting large-scale quantitative experiments in genomics. Using the capability of the DNA microarrays, we can measure changes in the transcription rate of nearly all the genes in a genome in disease states, during development, and in response to gene disruptions and drug treatment. Due to the limited sensitivity, however, researchers have to start with a large amount of sample, which usually requires PCR or other amplification of collected specimens. Using our microfluidic concentrator, we require only a small amount of samples in the range of few microliters for assays. Furthermore, we can reduce the detection time drastically by reducing the diffusion length through concentration. Since no PCR is required, the system can be much simpler and less expensive. By using a concentrator-enhanced microarray platform, we will be able to identify new genes and complex mutations in disease-causing human genes at unprecedented sensitivity. In addition, the proposed work can easily be extended to other types of assays such as immunoassays and other highly multiplexed biosensors. Once fully developed, the concentrator-enhanced microarray device will become an indispensable high-throughput tool for “omics” technologies.

#### About the Speaker:

Rafael Y. Song's research and teaching interests are interdisciplinary in both mechanical engineering disciplines such as design and manufacturing of MEMS devices, fluid mechanics, and micro/nanofabrication, as well as in biological engineering areas such as BioMEMS devices for separation and detection of biomolecules, neuroprosthetic implants, and transport phenomena in biological systems. He received his B.S., M.S., and Ph.D. in mechanical engineering from RWTH Aachen University, Germany in 1996 and worked at the Korea Institute of Science and Technology (KIST) as a Senior Research Scientist. He joined the Fraunhofer USA as a Senior Engineer in 2001 and worked in the Micro/Nanofluidic BioMEMS Group in the Department of Electrical Engineering and Computer Science at MIT as a Research Scientist. He held an appointment as a Research Fellow at the Beth Israel Deaconess Medical Center in Boston until he joined NYUAD in September 2012. He currently holds a joint appointment at the Department of Chemical and Biomolecular Engineering at the Polytechnic School of Engineering of New York University. Rafael Y. Song was awarded the Postdoctoral Fellowship from Merck/Computational Systems Biology Initiative of MIT for 2004-2006 and an Outstanding Research Team Award from President of KIST in 2000. He is a recipient of the German Konrad-Adenauer-Foundation Scholarship.

**Location:** BioSyM, SMART Centre,  
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138602

**Date:** 25<sup>th</sup> April, 2014 (Friday)  
**Time:** 3.30 PM