Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Nanopore-Based Detection of Biomarker for Cancer Diagnostics

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Abstract—DNA methylation is an epigenetic modification of DNA in which methyl groups are added at the 5-carbon position of cytosine (5mC). Aberrant DNA methylation, which has been associated with carcinogenesis, can be assessed in various biological fluids and potentially be used as biomarkers for detection of cancer. In this talk, I will present a nanopore-based direct methylation detection assay using methyl-binding proteins (MBPs), which selectively label the methylated DNA. The nanopore-based assay using moleucular-scale pores in a variety of diameters distinguished 827 bp-long methylated DNA/MBP complexes from unmethylated DNA, selectively detects 90 bp methylated DNA/MBP over unmethylated DNA, and discriminated hypermethylated DNA/MBP and unmethylated DNA on 90 bp, 60 bp, and 30 bp DNA fragments. Furthermore, these nanopore assays can detect CpG dyads in DNA fragments and could someday profile the position of methylated CpG sites on DNA fragments. This nanopore-based methylated sensitive assay could circumvents the need of conventional methods for bisulfite conversion, fluorescent labeling, and PCR and could therefore prove very useful in studying the role of epigenetics in human disease.

Bio—Jiwook Shim is currently a research scientist, leading the solid-state nanopore group under Prof. Rashid Bashir's direction, in the Micro and Nanotechnology Laboratory at the University of Illinois at Urbana-Champaign (UIUC). He obtained M.S. in Electrical and Computer Engineering and Ph.D. in Bio-engineering at University of Missouri in 2004 and 2008, respectively, and he continued working another year with his Ph.D. advisor as a postdoctoral fellow. In 2009, Dr. Shim joined Beckman Institute for advanced science and technology at UIUC as a postdoctoral research associate, and then he continued working as postdoctoral research associate at Micro and Nanotechnolgy Laboratory. His research interests include novel applications of nanotechnology for healthcare and developing a method to utilize nanotechnology for disease diagnostics tools.

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