Nanohour

Wednesday, September 24, 2014 3:00 pm

Beckman Institute – Room 4269

Investigation of Single-Molecule Structural Change and Detection of Molecular Biomarker for cancer

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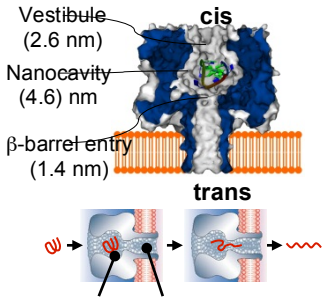
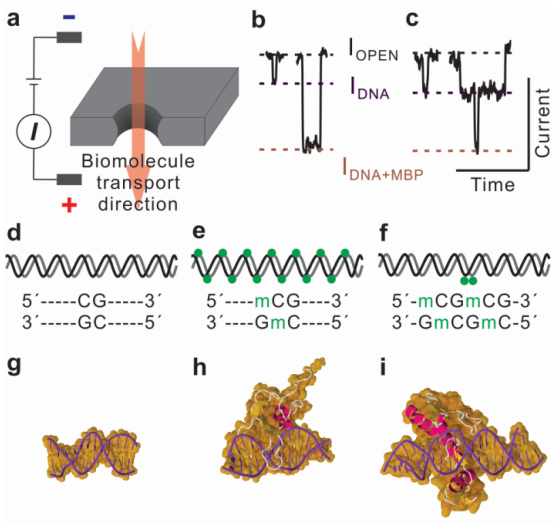
The nanopore has been adapted to explore many biophysical questions through single-molecule investigation. In this talk, we discuss two novel nanopore-based methods: exploring structural change of single-molecule and detecting molecular biomarker for cancer.

We discuss the development of a nanopore encapsulating single-molecule method for exploring how cations regulate the folding and unfolding of the G-quadruplex formed by the thrombin-binding aptamer (TBA, GGTTGGTGTGGTTGG). The signature blocks in the nanopore revealed that the G-quadruplex formation is cation-selective and is correlated with the G-quadruplex volume, which varies with cation species. Understanding these ion-regulated properties of oligonucleotides is beneficial for constructing fine-tuned biosensors and nano-structures. The methodology in this work can be used for studying other quadruplexes and protein-aptamer interactions.





Aberrant DNA methylation, an epigenetic modification of methyl groups at the 5-carbon position of cytosine (5mC), is associated with carcinogenesis. We present a nanopore-based direct methylation detection assay that circumvents bisulfite conversion and PCR. We use methyl-binding proteins (MBPs), which selectively label the modified bases in methylated DNA. The nanopore assay we have developed selectively detects methylated DNA/MBP complexes through a 19 nm nanopore with significantly deeper and prolonged nanopore ionic current blocking, while unmethylated DNA molecules are not detectable due to their smaller diameter. Discrimination of hypermethylated and unmethylated DNA on 90 bp, 60 bp, and 30 bp DNA fragments is then demonstrated using sub 10 nm nanopores. Hypermethylated DNA fragments fully bound with MBP are differentiated from unmethylated DNA at 2.1-fold to 6.5-fold current blockades and 4.5-fold to 23.3-fold transport durations.

Coffee and cookies will be served

http://nanohour.beckman.illinois.edu/Nanohour/Nanohour.html